Servicing Instructions

CardioServ/ CardioServVF

Version 4

227 483 02-B SA(e)

marquette HELLIGE MEDICAL SYSTEMS

Caution:
During repairs/service interventions, observe the protective measures against damage due to ESD.

* Marquette Hellige GmbH considers itself responsible for the effects on safety, reliability, and performance of the equipment, only if:

  - assembly operations, extensions, readjustments, modifications, or repairs are carried out by Marquette Hellige GmbH or by persons authorized by Marquette Hellige GmbH,

  - the electrical installation of the relevant room complies with the applicable national and local requirements, and

  - the instrument is used in accordance with the instructions for use.

* This manual contains service information; operating instructions are provided in the operator's manual of the instrument.

* This manual is in conformity with the instrument at printing date.

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Contents

1. General Introduction 5

2. General overview of CardioServ 7
2.1 Documentation and nomenclature of Marquette Hellige instrument part Nos 7
2.1.1 Configuration of instrument part No 7
2.1.2 Configuration of the PCB part Nos 7
2.1.3 Instrument status documentation (nominal status) 8
Instrument Versions 9

3. Functional Description 11
3.1 Pcb. usage on different CardioServ (4.x) Version‘s 17
3.2 Important Servicing Note: 21

4. Signal names 23
4.1 Pin configuration of panel connectors 29
4.1.1 Socket SpO2 303 443 57 29
4.1.2 Socket ECG 303 442 99 30
4.1.3 Socket Option 303 445 17 30
4.1.4 Socket Paddle 303 444 16 31

5. Block Diagram CardioServ VF/V4 33

6. Assembly Instructions 35

7. Troubleshooting Hints 37
7.1 Error Codes in the CardioServ Self-Test Screen 39

8. Adjustment Instructions 41

9. Technical Specifications CardioServ/CardioServ VF 49

10. Maintenance and Technical Inspection 57
10.1 General Information 57
10.2 Testing Equipment 58
10.3 Visual Check 60
10.4 Performance Check 60
10.4.1 Power-up Test 60
10.4.2 Key Test 60
10.4.3 Printer Test 61
10.4.4 Energy Test 61

10.4.5 Pacemaker Test (Without pacemaker testing adapter) 62
10.4.6 Pacemaker Test (with Marquette Hellige testing adapter) 63
10.4.7 SPO2 Performance Check 64
10.4.8 ECG Test 65
10.4.9 Cardioversion Test 65
10 4.10 Option Socket Input Test 65
10.5 Battery 66

11. Safety Analysis Test 67
11.1. General introduction 67
11.2 Recommended Test Equipment 67
11.3 Protective Earth Resistance Test 67
11.3.1 Leakage Current Measurement 68
11.3.2 Enclosure Leakage Current Test 68
11.3.3 Patient Leakage Current Test 69
12. Spare Parts Lists 71
13. Accessories: Car holder 75
14. Appendix: Drawings

Revision History

December 1997 Initial Release SW Version 4

1. General Introduction

CardioServ Semi-Automatic and Manual

There are 2 CardioServ models: the semi-automatic and the manual defibrillator. Both models are available with a pacemaker and SpO2.

The manual CardioServ is a defibrillator designed to deliver synchronized and unsynchronized shocks. This requires the user to trigger capacitor charging and shock delivery manually.

The semi-automatic defibrillator is equipped with analysis software, which monitors the ECG for arrhythmias (fibrillation and ventricular tachycardia). When the analysis is started by pressing a key the ECG is analyzed. If the result of the analysis is positive, the capacitor is charged to the preselected energy level. The semi-
automatic operating mode can be terminated by pressing a key or inserting the dongle.

2. General overview of CardioServ

2.1 Documentation and nomenclature of Marquette Hellige instrument part Nos

2.1.1 Configuration of instrument part No

The instrument part No comprises 8 digits, the first 6 digits determining the instrument type, the last 2 digits the instrument version. The language is determined by configuration, thus having no influence on the part No.

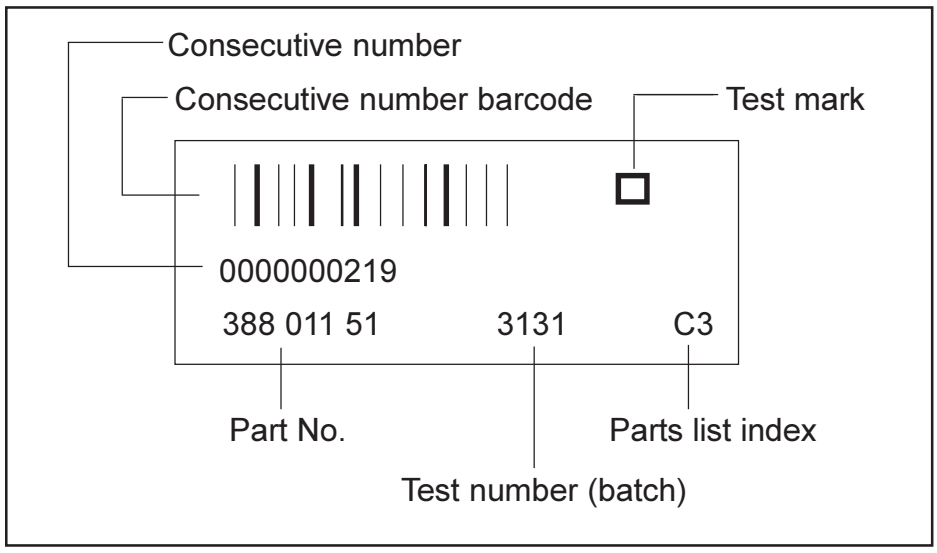
E.g. Instrument Type	Version
CardioServ	101 116 ..
without pacemaker	101 116 03
with SPO_2	101 116 04
with pacemaker and SPO_2	101 116 05

2.1.2 Configuration of the PCB part Nos

388 xxx yy Spare part numbers for the operative PCBs.

The instrument documentation, e.g., reference diagrams, circuit diagrams and parts lists are listed under this part No.
The 388 number is located on the barcode label.

Configuration of the barcode labels:



303 xxx yy Spare part numbers for PCBs tested especially thoroughly

303 numbers are only given to PCBs where the level of testing applied to 388 PCBs is inadequate for implementation when servicing in the field, or where only a complete set of PCBs can be replaced in the field.
In addition to a barcode label (388 number) 303 part Nos also have an additional label with a 303 number and are to be found in the spare parts list under this number.

389 xxx yy Replacement numbers for defective PCBs

Where servicing is required 389 PCBs are available for the replacement of some PCBs. When using a replacement PCB (389 part No) the defective PCB is to be returned to the Freiburg factory. Replacement PCB part Nos are included in the spare parts list.
389 PCBs have an additional adhesive label.

2.1.3 Instrument status documentation (nominal status)

Due to the hardware and software combination unambiguous documentation of the instrument assembly status is necessary, also in the event of repairs.

This documentation comprises the following documents and measures:

Master Record Index (MRI) (see Appendix)

This document is a component of this instrument documentation.

This document states the combination of permissible hardware and software for a particular instrument version. The permissible PCB Index is given in the “Index” column with each update delivered. Further permissible PCB Indexes are given in the “compatible” column. The PCB Index can be found in the PCB barcode label.

Product Status Index

This document is created during manufacture. The Product Status Index documents the hardware/software product status.

Instrument Versions

These servicing instructions describe the manual CardioServ and the semi-automatic CardioServ VF

Manual CardioServ

101 117 01 CardioServ without pacemaker, without SPO2
101 117 03 CardioServ with pacemaker, without SPO2
101 117 04 CardioServ without pacemaker, with SPO2
101 117 05 CardioServ with pacemaker, with SPO2

101 117 02 CardioServ Esaote without pacemaker, without SPO2
101 117 06 CardioServ Esaote with pacemaker, without SPO2
101 117 07 CardioServ Esaote without pacemaker, with SPO2
101 117 08 CardioServ Esaote with pacemaker, with SPO2

101 117 09 CardioServ USA without pacemaker, without SPO2
101 117 11 CardioServ USA with pacemaker, without SPO2
101 117 12 CardioServ USA without pacemaker, with SPO2
101 117 13 CardioServ USA with pacemaker, with SPO2

CardioServ VF

101 117 21 CardioServ without pacemaker, without SPO2
101 117 22 CardioServ with pacemaker, without SPO2
101 117 23 CardioServ without pacemaker, with SPO2
101 117 24 CardioServ with pacemaker, with SPO2

101 117 29 CardioServ Esaote without pacemaker, without SPO2
101 117 30 CardioServ Esaote with pacemaker, without SPO2
101 117 31 CardioServ Esaote without pacemaker, with SPO2
101 117 32 CardioServ Esaote with pacemaker, with SPO2

101 117 25 CardioServ USA without pacemaker, without SPO2
101 117 26 CardioServ USA with pacemaker, without SPO2
101 117 27 CardioServ USA without pacemaker, with SPO2
101 117 28 CardioServ USA with pacemaker, with SPO2

3. Functional Description

The Therapy System CardioServ comprises a defibrillator, a monitor (LC display 240 * 320 pixels), a printer and a power supply unit. These components are arranged in a casing. It is a compact unit, which can also be implemented using a 230-V power supply system, even without a battery. The unit has a pulsed 140-mA standard charge for the battery. Additional versions available have an external pacemaker and an SpO2 module, separately or combined.
The Defi is switched on by turning the rotary switch to position ECG or energy levels automatic sequence 2 ... 360 J.
Following a self-test, which tests

- RAM data store
- ROM program memory
- Watchdog / Reset
- EEPROM permanent memory
- Display all Pixels on / off
- Time base of internal quartz crystal
- Energy charge from last shock
- Defective charge or Defib keys
- Position of energy selector switch
- Connected electrodes
- Pacemaker
- SpO2

the Defi is ready for operation. If an error arises, depending on the severity of the error, the Defi is either on standby or not. Serious errors are watchdog, ROM or RAM errors. In the case of minor errors, an error message appears, but the instrument can be rendered operative by pressing a key.

The Defi shock is delivered via exchangeable paddles. This permits the use of different electrodes, i.e., in addition to conventional electrodes, large-surface adhesive electrodes or internal electrodes, for example. Adhesive electrodes are used for the pacemaker. The CardioServ also has Start and Trigger buttons on the instrument.

The charge operation is actuated with the Charge key on the apex electrode (for internal and adhesive electrodes on the instrument). During the charge operation, the accumulation of energy is registered and when the selected energy level has been reached the energy to be released appears on the display. An acoustic and visual display on the monitor indicates the configured energy level has been reached. When the battery is fully charged or with line-power operation, charging at 360 J should take about 8 s.

The buttons on both electrodes are pressed to trigger the defibrillation pulse (safety two-hand operation). This means that the button on the apex electrode (or the corresponding one on the instrument) has two functions:

- start the charge operation
- trigger defibrillation (together with the Trigger button)

The type of electrodes connected are recognized and, in the case of internal electrodes, the energy is automatically limited to 50 joules.

Following defibrillation, the energy released is displayed on the screen for 6 seconds. Documentation output is by the printer.

The defibrillator has three operating modes:

* synchronized defibrillation (cardioversion)
* unsynchronized defibrillation (emergency therapy)
* semi-automatic (emergency service)

Cardioversion (operating mode Sync) can proceed either via the paddles or a patient cable. The operating mode Sync appears on the display and Sync marks are superimposed on the display. Following cardioversion, for safety reasons, the CardioServ switches automatically over to the unsynchronized operating mode, i.e., before each cardioversion the instrument must be switched over to Sync.
The Defi can be configured for semi-automatic operation in three ways:
* As a semi-automatic instrument only (defibrillation only possible via analysis)
* Semi-automatic instrument which can be toggled to manual mode by pressing a key
* Semi-automatic instrument which can be reset into manual mode using a dongle

ECG signal pick-up is possible via the paddles or ECG cable. ECG is output on the LCD display or by the built-in 50-mm printer.

A safety device ensures the discharge of the storage capacitor in the following situations:

- when defibrillation is not triggered 30 seconds after storage operation is complete,
- 0.2 seconds after triggering defibrillation,
- immediately after switching back the energy selector switch during or after storage,
- when the battery voltage drops below a certain level,
- when the selected energy level still has not been reached after 32 seconds.

When switching to a higher energy level, the energy deficit is supplied by recharging.

Pacemaker

The pacemaker is a transthoracic pacemaker operating in the Demand and Fix mode.
- Pulse width 40ms (20 ms)
- The frequency is between 0...180 P/min (> 150 P/min only 20ms pulse width)
- The current is between 0...200 mA
- Adjustment is in 5-unit intervals.

The pacemaker is operated using 6 keys on the control panel. One key switches the pacemaker on, one key changes the operating mode, the other keys are used to adjust the frequency and current. The defibrillator cannot be disabled as long as the pacemaker is switched on. The adhesive electrodes of the Defi are used to release a pulse. This ensures a rapid switch from defibrillator to pacemaker and back again.

SpO_2

SpO2 is based on one of the modules manufactured by Nellcor (MP204). This module is located on the PCB Analog and receives its power supply from the latter. Measurement of the oxygen saturation level and pulse frequency is made by this PCB.
Pulse frequency from 0...250 P/min
Saturation from 0...100%
We display the plethysmogram, saturation level and, when selected, the pulse frequency instead of the HR.

Control options:

A battery charge check is performed under load application. The message “charge battery” on the display means the battery needs recharging. At least five discharges at maximum energy are still possible. (Possibly even considerably more)

Performance check of defibrillation is performed by discharging into the integrated 50-ohm resistor.

Monitoring battery charge via the connector for power cord by the yellow LED. If the battery is fully charged after 16 h, trickle charging ensues, the yellow LED is permanently lit up.

The monitoring function of the CardioServ records and monitors the ECG and oxygen saturation level. The cardiac-action potentials are fed to the ECG preamplifier via a 5-wire patient cable. Selection can be made from 12 leads. The ECG curve is displayed on the LC screen with an illuminated background. The heart rate obtained from the ECG signal is continuously displayed on the screen.

Communication between the user and the instrument is via the keyboard and the LC screen. These also serve to configure the default settings and functions (see User’s Manual for further details).

The PCBs have the following functions:

PCB Power Supply

This PCB supplies the 16.5-V instrument power supply. 10 A can be supplied for short-term capacitor charging. It is a primary clock-rated wide-range power supply system. It operates from 85 .. 264 V, at 49 ... 65 Hz. It is protected by 2 fuses in the primary circuit. One on the PCB and one in the feed line.

PCB Analog

This PCB has several functional units.
The first unit accepts the ECG signals (patient input) received via the patient cable from the patient. In accordance with its task, it is connected to the patient by a cable. It is thus constructed as an application component isolated from other circuit components and the circuit reference (floating). The tasks of this circuit component are:
- amplification of ECG signals
- lead selection (lead selector)
- identification and reporting of electrode defects
- identification and reporting of patient lead connection
- digitization and serialization of ECG data
- potential separation of the application component from the remaining circuit components (floating)
- floating component power supply
- ECG trigger
- pacing-pulse detection

There are two of these circuit components on this PCB. Once for the ECG via paddles, once for the ECG via patient cable.
A second unit provides floating separation and the power supply for SPO_2.
A further circuit component controls high-voltage generation for the Defi shock. There is a high-voltage capacitor on this PCB. The functions are as follows :

- safety control during charging and shock release (1st path : hardware)
- controlling storage operation and energy release, independent of the CPU
- controlling the high-voltage generator
- elimination of interference in the operating elements in the Defi electrodes
- conversion of the voltage and current signals into a frequency to measure energy
- activation and control of the high-voltage transformer
- generation of the emergency cutoff signal in the event of inadmissibly high voltage
- measurement of the high voltage on the primary winding of the high-voltage transformer

- rectification of the high voltage
- protection of the high-voltage diode
- discharging the storage capacitor as a safety precaution
- measurement of the high voltage on the storage capacitor
- energy delivery via the high-voltage relay

A further unit organizes the entire instrument´s power supply. This is provided by the built-in battery, the power supply unit or, optionally, from an external battery (e.g., ambulance power supply system). It has the following tasks:
- switching instrument on/off
- automatic cutoff when battery voltage is too low
- monitoring the “charge battery” threshold
- power source selection: battery or power supply system
- charging the built-in battery by a special circuit independent of how high the supply voltage is

PCB Digital

The PCB Digital is equipped with the microcontroller, which controls the entire instrument. It comprises a Motorola 68332 microcontroller, RAM, EPROM, EEPROM, watchdog and I/O ports. It has the following functions:
- safety control during charging and shock release (2nd path : software)
- displaying the ECG and text on the LC screen (delete bar procedure)
- processing the curves and texts for the printer controller for output onto paper
- 50 / 60-Hz filter (software)
- alarm management

Circuit component display :
- graphics controller to control the display, which ensures screen refresh
- display RAM
- generation of voltages for the LCD (LCD power supply)
- generation of high voltage for background illumination
- Pal for chip select generation for display
- contrast adjustment

Circuit component real-time clock :
- real-time clock with lithium battery buffer and integrated quartz crystal
- Pal for chip select generation for clock

Circuit component 1-channel recorder :
- single-chip microcontroller to output data at thermal-array printhead
- monitoring printhead temperature
- motor control for paper transport
- switches off motor in the event of overload or underload

- generation of power supply voltages for the recorder
- processing of all signals for the printer microcontroller

Further circuit components on the PCB are :

- generation of 5 V from 12 V via an integrated switching controller, short-circuit-proof and protected against overvoltage by Transzorb diodes
- sound generator, frequency controlled by SW
- RS-232 interface, protected against overvoltage by Transzorb diodes. Interface integrated into microcontroller, external conversion of level from 5 V to +- 12 V.
- energy selector switch, binary coded, delivers its information to PCB Analog and to the microcontroller
- keyboard interface to connect the membrane keypad
- control of LEDs on the keypad
- watchdog
- reset generation, when +5-V supply drops below 4,65 V or exceeds 5,5 V
- RAM buffering by battery when instrument is switched off
- pacemaker functions integrated on PCB Digital
- serial hookup of pacemaker and microcontroller
- pacemaker conducts current when in operative mode only.

3.1 Pcb. usage on different CardioServ (4.x) Version‘s

	Pcb.Digital Spare 388 032 06 Exchange 389 004 25	Pcb.Digital Spare 388 032 53 Exchange 389 004 26	Pcb.Analog Spare. 303 445 43 Exchange 389 004 22	Pcb.Power Supply Spare 930 118 46	Pcb.SPO2 Spare 930 117 26
CardioServ 101 117 01 Version 4.x without pacemaker / without SPO2		x	x	x	
CardioServ 101 117 03 Version 4.x with pacemaker / without SPO2	x		x	x	
CardioServ 101 117 04 Version 4.x without pacemaker / with SPO2		x	x	x	x
CardioServ 101 117 05 Version 4.x with pacemaker / with SPO2	x		x	x	x
CardioServ 101 117 09 Version 4.x USA without pacemaker / without SPO2		x	x	x	
CardioServ 101 117 11 Version 4.x USA with pacemaker / without SPO2	x		x	x	
CardioServ 101 117 12 Version 4.x USA without pacemaker / with SPO2		x	x		x
CardioServ 101 117 13 Version 4.x USA with pacemaker / with SPO2	x		x	x	x

	Pcb.Digital Spare 388 032 06 Exchange 389 004 25	Pcb.Digital Spare 388 032 53 Exchange 389 004 26	Pcb.Analog Spare. 303 445 43 Exchange 389 004 22	Pcb.Power Supply Spare 930 118 46	Pcb.SPO2 Spare 930 117 26
CardioServ 101 117 02 Version 4.x ESAOTE without pacemaker / without SPO2		x	x	x	
CardioServ 101 117 06 Version 4.x ESAOTE with pacemaker / without SPO2	x		x	x	
CardioServ 101 117 07 Version 4.x ESAOTE without pacemaker / with SPO2		x	x	x	x
CardioServ 101 117 08 Version 4.x ESAOTE with pacemaker / with SPO2	x		x	x	x

Pcb. usage on different CardioServ VF (4.x) Version‘s

	Pcb.Digital Spare 388 032 06 Exchange 389 004 25	Pcb.Digital Spare 388 032 53 Exchange 389 004 26	Pcb.Analog Spare. 303 445 43 Exchange 389 004 22	Pcb.Power Supply Spare 930 118 46	Pcb.SPO2 Spare 930 117 26
CardioServ 101 117 21 Version 4.x without pacemaker / without SPO2		x	x	x	
CardioServ 101 117 22 Version 4.x with pacemaker / without SPO2	x		x	x	
CardioServ 101 117 23 Version 4.x without pacemaker / with SPO2		x	x	x	x
CardioServ 101 117 24 Version 4.x with pacemaker / with SPO2	x		x	x	x
CardioServ 101 117 25 Version 4.x USA without pacemaker / without SPO2		x	x	x	
CardioServ 101 117 26 Version 4.x USA with pacemaker / without SPO2	x		x	x	
CardioServ 101 117 27 Version 4.x USA without pacemaker / with SPO2		x	x		x
CardioServ 101 117 28 Version 4.x USA with pacemaker / with SPO2		x	x	x	

	Pcb.Digital Spare 388 032 06 Exchange 389 004 25	Pcb.Digital Spare 388 032 53 Exchange 389 004 26	Pcb.Analog Spare. 303 445 43 Exchange 389 004 22	Pcb.Power Supply Spare 930 118 46	Pcb.SPO2 Spare 930 117 26
CardioServ 101 117 29 Version 4.x ESAOTE without pacemaker / without SPO2		x	x	x	
CardioServ 101 117 30 Version 4.x ESAOTE with pacemaker / without SPO2	x		x	x	
CardioServ 101 117 31 Version 4.x ESAOTE without pacemaker / with SPO2		x	x	x	x
CardioServ 101 117 32 Version 4.x ESAOTE with pacemaker / with SPO2	x		x	x	x

3.2 Important Servicing Note:

Replacing CardioServ PCBs

When CardioServ PCBs are replaced the technician must call up the self-test screen after replacing the PCB. The new components are reported automatically in the software configuration. After restarting CardioServ recognizes the new components. This is important in the case of SpO2 and Pacemaker. Further the Performance Check (see on Page 62) needs to be accomplished.

Replacing PCB Digital

The identification numbers 0000 and 1111 are stored in the Eeprom of the PCB Digital for CardioServ Manual and CardioServ VF, respectively.

The replacement PCB always has the identification number 0000 stored in the Eeprom for CardioServ Manual.

If during servicing the replacement PCB Digital is inserted into a CardioServ VF, when it is switched on the CardioServ is in the manual mode. The following combinations of keys are required to switch the CardioServ from manual to semi-automatic operation.

1. Press F1 and F5 keys simultaneously: The function **Configuration** appears on the screen.

2. Press F3 and F4 keys simultaneously: The function **Key Test** appears on the screen.

3. Press the Analysis key.

4. Press F3 and F4 keys simultaneously.

The identification code for the CardioServ VF stored in the Eeprom of the PCB Digital is now 1111 and the CardioServ operates in the semi-automatic mode.

4. Signal names

Interface Signals PCB DIGITAL <-> PCB ANALOG Connector

Note: I/O from processor 68332 viewpoint

Signal Name	I/O	Meaning	Level	Polarity
ENSELD-ENSELA	I/O	Selection of energy level or device On/Off or position ECG DCBA HHHH -> locked mechanically, reaction to error HHHL -> Device off HHLH -> ECG HHLL -> 2J HLHH -> 5J HLHL -> 7J HLLH -> 10J HLLL.-> 20J LHHH -> 30J LHHL -> 50J LHLH -> 70J LHLL -> 100J LLHH -> 150J LLHL.-> 200J LLLH -> 300J LLLL -> 360J	+5V	---
TACHARGE	----	Charging signal from keypad	+5V	high-active
TADISCHARGE	----	Discharge signal from keypad	+5V	high-active
TAENABLE	O	Release signal for shock release via keypad	+5V	high-active
CHARGE_	I	Charging OR signal from keypad and paddle	+5V	low-active
DISCHARGE_	I	Discharge OR signal from keypad and paddle	+5V	low-active
PAPRINT	I	Triggers printout	+5V	high-active
ENERGY- SELECTED	O	L=enables HV generator start H=switches HV generator and HV off Reset position or lead interrupt = high	+5V	low-active
RELEASE	I	Message D relay on	+5V	high-active
SYNC_	O	Triggers Defi shock in SYNC mode off. Is low in normal mode. Prevents shock release when high	+5V	low-active
RESDEF_	O	Reset Defi	+5V	low-active
AIMESS	O	Enables pick-up of C relay, toggles between current and voltage measurement L=C relay off, voltage reading H=C relay on, current reading	+5V	high-active
RELE	O	Switches E relay on, thereby enabling pick-up of C relay L=E relay not picked up H=E relay picked up	+5V	high-active

Signal Name	I/O	Meaning	Level	Polarity
GEST	I	With a L->H change shows when the generator was started and with H->L change when the selected energy level is reached. (Detection by oscillator reverse voltage)	+5V	high-active
ELEC1 - ELEC3	I	Defi Electrode Identification 321 HHH -> External Electrode HLL -> Adhesive Electrode LHL -> Internal Electrode Other	 +5V	 ----
U_F	I	Current or Voltage Measurement Converted into Frequency	+5V	----
PWON_	----	Stop Signal for Electronic Relay (Device-On/Off)		low-active
BATLOW_	I	Battery Undervoltage	+5V	low-active
BATLAD_	I	Battery Charge Display	+5V	low-active
12VBAT	----	12-V Standby Power Supply for Static RAMs	+12V	----
LINE	----	Line-Power Operation Display	+12V	high-active
MISOEXT	I	Master-In Slave-Out (Buffered)	+5V	----
MOSIEXT	O	Master-Out Slave-In (Buffered)	+5V	----
SCKEXT	O	QSPI Serial Clock (Buffered)	+5V	----
PCS1EXT_	O	Peripheral Chip Select1 (Buffered)	+5V	low-active
PCS2EXT_	O	Peripheral Chip Select2 (Buffered)	+5V	low-active
GND	----	Ground Reference Level 5-V Supply	0V	----
+5V	----	+%V Power Supply	+5V	
RESETB_	O	Buffered Reset Signal	+5V	low-active
RX_SPO2	I	UART Signal Received Data for SPO2	+5V	-----
TX_SPO2	O	UART Signal Transmit Data for SPO2	+5V	-----
EKTRIG_	O	ECG Trigger für SPO2	+5V	-----
RESSPO2	O	Reset SPO2	+5V	low-active
RxD	I	Receive Data RS232	+5V	
TxD	O	Transmit Data RS232	+5V	
GND1V	O	Ground Analog 1Volt Out	+5V	
A!VOUT	O	Signal Analog 1Volt Out	+5V	

Interface Signals PCB DIGITAL <-> PCB ANALOG Connector PS

Signal Name	I/O	Meaning	Level	Polarity
GND_ANA	----	Ground	0V	----
+12V_ANA	----	+12V Power Supply	+12V	----
+5V-ANA	----	+5V Power Supply	+5V	----

Interface Signals PCB DIGITAL <-> Printhead/Motor Interface Connector PRINT

Note: I/O from processor 80C51 or motor control viewpoint

Signal Name	I/O	Meaning	Level	Polarity
KLA,	O	Printhead Latch Signal	+5V	high-active
KCLK	O	Printhead Clock Signal	+5V	L->H
KDAT	O	Printhead Data Signal	+5V	----
KSTRB	O	Printhead Strobe Signal	+5V	high-active
TERM1	I	Printhead Thermistor Connector1	+5V	----
TERM2	I	Printhead Thermistor Connector2	+5V	----
GNDJ	----	Ground Thermal-Array Printhead	0V	----
+5V	----	++5V Power Supply Thermal-Array Printhead	+5V	----
+22V	----	+22V Power Supply Thermal-Array Printhead	+22V	----
VDD1	O	Release Signal for Thermal-Array Printhead Overvoltage	+22V	high-active
MOTOR+	O	Motor Connector +	var	----
MOTOR-	O	Motor Connector -	var	----
SENSE	I	Motor Current Sensor Signal	var	----

Interface Signals PCB DIGITAL <-> LCD Connector AD (HOSIDEN HLM6323)

Note: I/O from Graphics Controller viewpoint

Signal Name	I/O	Meaning	Level	Polarity
V0	O	Contrast Voltage	var.	----
VEE	----	Negative Power Supply for LCD	-23V	----
D3-D0	O	Serial Pixel Data	+5V	----
M	O	LCD Drive Signal (AC Signal)	+5V	----
VSS	----	Ground	+0V	----
VDD	----	+5V Power Supply	+5V	----
CP2	----	Display Data Shift Clock	+5V	H->L
CP1	----	Display Data Latch Signal	+5V	H->L
S	O	Frame Signal	+5V	high-active
DISP_OFF_	O	Display ON/OFF H=Display ON L=Display OFF	+5V	low-active
FG	----	Frame Ground	0V	----

Interface Signals PCB DIGITAL <-> LCD Connector AE (HOSIDEN HLM8619)

Note: I/O from Inverter viewpoint

Signal Name	I/O	Meaning	Level	Polarity
FL HOT	O	High Voltage for CCFT	----	----
FL GND	O	High-Voltage Ground	----	----

Interface Signals PCB DIGITAL<->LCD Connector AF (OPTREX DMF50174NF- FW)

Note: I/O from Graphics Controller viewpoint

Signal Name	I/O	Meaning	Level	Polarity
FLM	O	Frame Signal	+5V	high-active
LP	----	Data Latch Signal	+5V	H->L
CP	O	Clock Signal for Shifting Serial Ddta	+5V	H->L
M	O	Alternate Signal for LCD Drive	+5V	----
VADJ	----	Contrast Signal	var	----
VCC_	----	+5V Power Supply	+5V	----
VSS	----	Ground	0V	----
VEE	----	-23V Power Supply	-23V	----
D3-D0 DISP_OFF__	O O	Display Data Display ON/OFF H=Display ON L=Display OFF	+5V +5V	---- low-active

Interface Signals PCB DIGITAL<->LCD Connector AG (OPTREX DMF50174NF- FW)

Note: I/O from Inverter viewpoint

Signal Name	I/O	Meaning	Level	Polarity
FL HOT	O	High Voltage for CCFT	----	----
FL GND	O	High-Voltage Ground	----	----

Interface Signals PCB DIGITAL <-> Keypad Interface Connector AH

Note: I/O from processor 68332 viewpoint

Signal Name	I/O	Meaning	Level	Polarity
KBROW0_ KBROW1_ KBROW2_ KBROW3_	O	Keypad Matrix Columns	+5V	low-active
KBCOL0_ KBCOL1_ KBCOL2_ KBCOL3_	I	Keypad Matrix Lines	+5V	low-active
TAENABLE	O	Release Signal for Key Charge/Defib + Defib	+5V	high-active
TACHARGE	I	Charge/Defib Key	+5V	high-active
TADISCHARGE	I	Defib Key	+5V	high-active
ON_OFF_	O	On/Off Key	+5V	----
GND	----	Ground	0V	----
LINE	----	Line LED	+12V	high-active
BAT	O	Battery Undervoltage LED	+5V	high-active

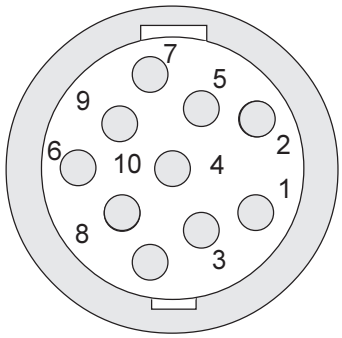
Interface Signals PCB Potential Separation <->Nellcor MP204

Signal Name	I/O	Meaning	Level	Polarity
TX	O	Transmit	+5V	high-active
RX	O	Receive	+5V	high-active
EK_SYN	1	ECG Trigger Signal	+5V	high-active
RESET_	0	Reset	+5V	low-active
GNDF	----	Ground	0V	----

4.1 Pin configuration of panel connectors

4.1.1 Socket SpO_2 303 443 57

Marquette Hellige input socket, circular version
Blue mark on plug

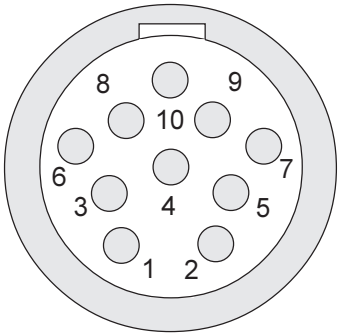


Front view

	On device
1	Anode Photodetector
2	nc
3	nc
4	Cathode Photodetector
5	GND
6	R(cal)
7	LED - (Red LED Cathode, IR_LED Anode)
8	nc
9	LED + (Red LED Anode, IR_LED Cathode)
10	GND Screen

4.1.2 Socket ECG 303 442 99

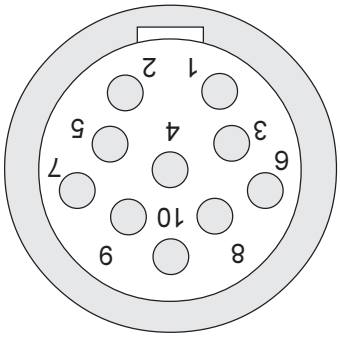
Marquette Hellige input socket, circular version
Green mark on plug



Front view

	5-Lead Cable	3-Lead Cable
1	Input R	R
2	Input C	L
3	Input F	F
4	Input N	---
5	Input L	---
6	Ident Cable Connected	Ident Cable Connected
7	GND floating	GND floating
8	---	---
9	Ident 5-Lead Cable	---
10	Screen	Screen

4.1.3 Socket Option 303 445 17

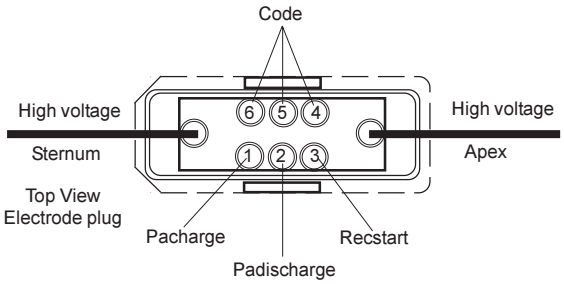


Front view

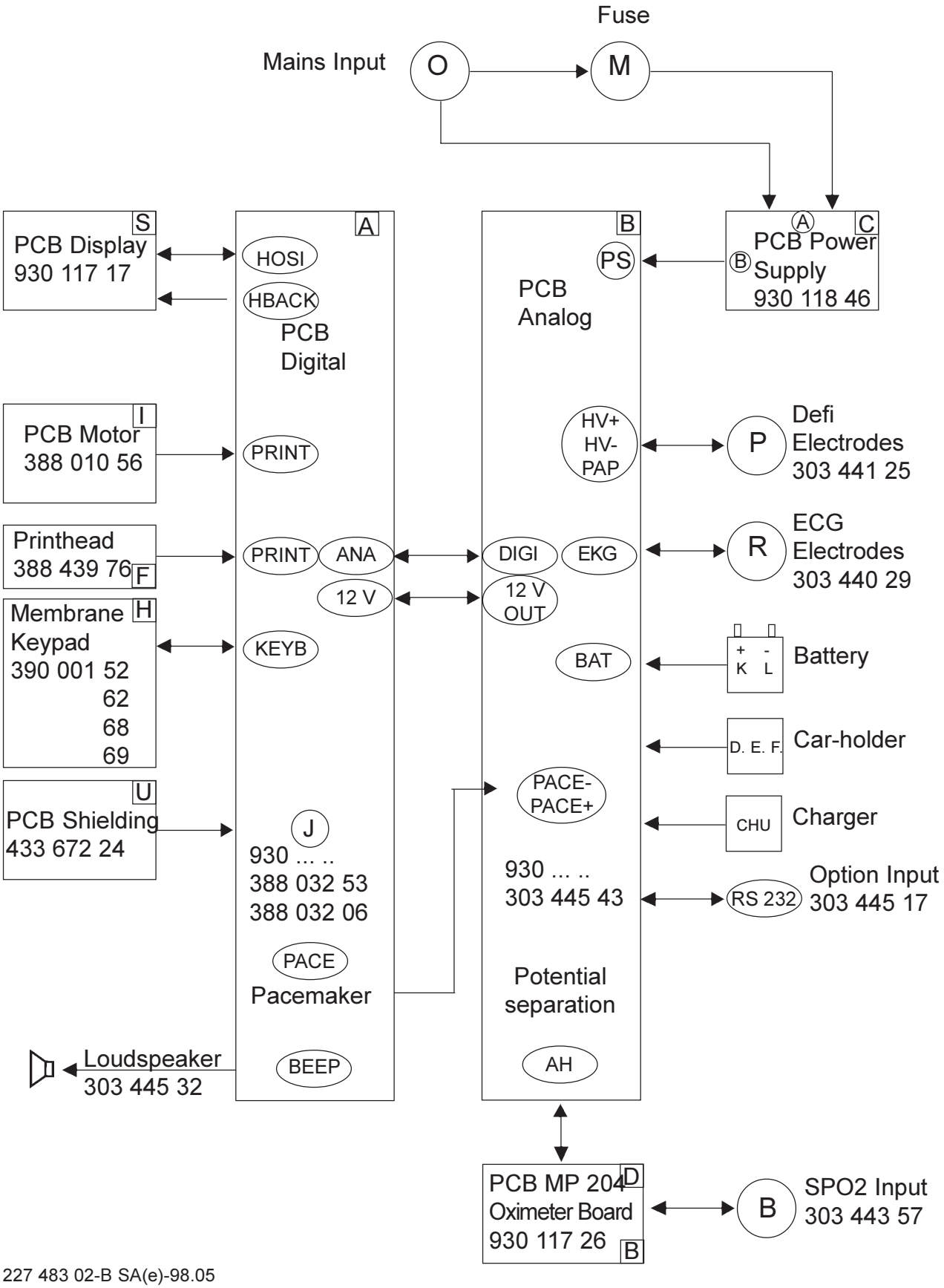
1	---
2	TX
3	RX
4	---
5	---
6	---
7	GNO
8	VCC
9	ECG
10	GND ECG

4.1.4 Socket Paddle 30344416

1 PACHARGE
2 PADISCHARGE
3 RECSTART
4 CODE
5 CODE
6 CODE
High Voltage / Pace / Apex
High Voltage/ Pace / Sternum



5. Block Diagram CardioServ VF/V4



6. Assembly Instructions

General Information:
Before opening the CardioServ switch the instrument off, disconnect power cord plug, remove battery and implement ESD protection measures. Return replacement PCB in ESD packaging only

Opening the instrument:
Undo the 9 screws on the bottom of the device, place upper case shell to the left next to the instrument.

Removing the PCB Digital:
The PCB Digital is located in the upper shell. Disconnect the 50-pin flat strip cable and the 2-pin 12-V power supply cord. The recorder, plugged into the lower case shell, can be removed and the flat strip cable connected to the thermal-array printhead and motor disconnected. Lay the upper shell “face down”, remove the screening plate fixed in place by a screw and 5 plastic catches. Remove the insulating card. Undo the 8 PCB Digital fastening screws (leave the 4 display screws in place) and remove the rotating knob of the energy selector switch. **Carefully** lift up the PCB and pull out the membrane keypad connector on the left. The PCB Digital can now be removed along with the display screen.

Removing the display screen:
-Disconnect plug-in connector to display illumination.
-**Carefully** pull the zero power connector safety catch of the display-membrane keypad connector upwards and disconnect membrane keypad lead.
- Remove the 4 display fastening screws

Removing the PCB Analog:
Disconnect 50-pin flat strip cable, connection cable to the battery, power supply unit and PCB Digital. Detach connector to the ECG socket and disconnect connections to Defi socket. Remove ECG amplifier cover with 3 screws and 2 plastic catches. Unscrew the 10 screws on the PCB Analog (4 capacitors, 2 high-voltage oscillators) and 3 hexagonal columns.

7. Troubleshooting Hints

Device cannot be switched on during line-power operation:

- 230-V power supply via power supply unit OK ? Measure at connector CA.
- Connector 230-V plug to power supply unit OK ?
- Fuse in feed line and on power supply unit OK ?
- Lead line-power supply unit -- PCB Analog OK ?
- Lead PCB Analog -- PCB Digital (2-pin power supply 16V) OK ?
- Lead PCB Analog -- PCB Digital (50-pin control) plugged in correctly?
- 16 V on PCB Analog at connector ? no --> power supply unit defective or short-circuit (power supply unit tackered)
- Fuse SI500 (16V) on PCB Digital OK ?
- Fuse SI502 (5V) on PCB Digital OK ?
- “Device On Signal” PWON_ present and 16V available on PCB Digital : yes --> Digital defective
- PCB Analog or PCB Digital defective ?

Device cannot be switched on during battery operation:

- Battery charged?
- Lead battery contacts -- PCB Analog OK ?
- Fuse for battery on PCB Analog OK ?
- Connector battery contact and connector power supply PCB Digital confused
- Fuse SI500 (16V) , SI502 (5V) on PCB Digital OK ?
- PCB Analog defective ?

Device does not print out:

- Paper inserted correctly? (thermosensitive side facing up)
- Flat strip cable to printer OK ?
- Mechanical failure in paper transport, paper feed ?
- Without paper platin runs approx. 1 sec
- Flap not completely closed
- Print key on membrane keypad does not respond when pressed (perform key test)
- Does motor run ? or printhead voltage there ? or movement on the data lines to printhead ? no --> PCB Digital defective ?

Pacemaker mode disabled

- No +5V power supply on floating side
- Pacemaker cable not plugged in correctly

No display on LCD

- Contrast poorly adjusted ? (change contrast)
- Contrast keys defective ? (perform key test)
- Connector for illumination or data OK ?
- Illumination defective ?
- Fuse SI500 (16V) , SI501(background illumination) , SI502 (5V) on PCB Digital OK ?
- Display defective ?
- PCB Digital defective ?

No ECG on display via ECG cable or paddles

- Connector to ECG socket OK ?
- Connector to paddles OK ?
- Lead PCB Analog -- PCB Digital (50-pin control) OK ?
- ECG via paddles or ECG cable OK : --> PCB Analog defective
- PCB Analog or PCB Digital defective ?

Battery does not charge:

- Yellow LED must glow when battery is being charged
- Fuse SI501 on PCB Analog defective ?
- Check connector to battery
- Voltage on power supply unit under 16 V

Self-test:

F1 + F5 simultaneously to go to configuration and with Print print out the current error messages
In configuration with F3 + F4 key test and carry out printer adjustment (Print key)
In configuration with F3 + F5 restore default (factory setting)
Display test chessboard pattern at power up
Error in time base : The clock must be set once or PCB Digital defective
Error in energy storage : Adjust energy storage / measurement or PCB Analog defective
Error RAM, ROM, Display-RAM, permanent memory, watchdog : PCB Digital defective.
Error Charge or Discharge actuated (key sticking).

Troubleshooting hints for PCB SPO2

When the PCB SPO2 is inoperative or operates defectively check the 5V floating voltage. The voltage must lie between 4.8-4.9V.

7.1 Error Codes in the CardioServ Self-Test Screen

0002 : RAM error
0004 : RAM error
0008 : RAM error
0010 : ROM error
0020 : EEPROM error
0100 : Clock error
0200 : Charge key error
0400 : Discharge key error
0800 : Energy outside range

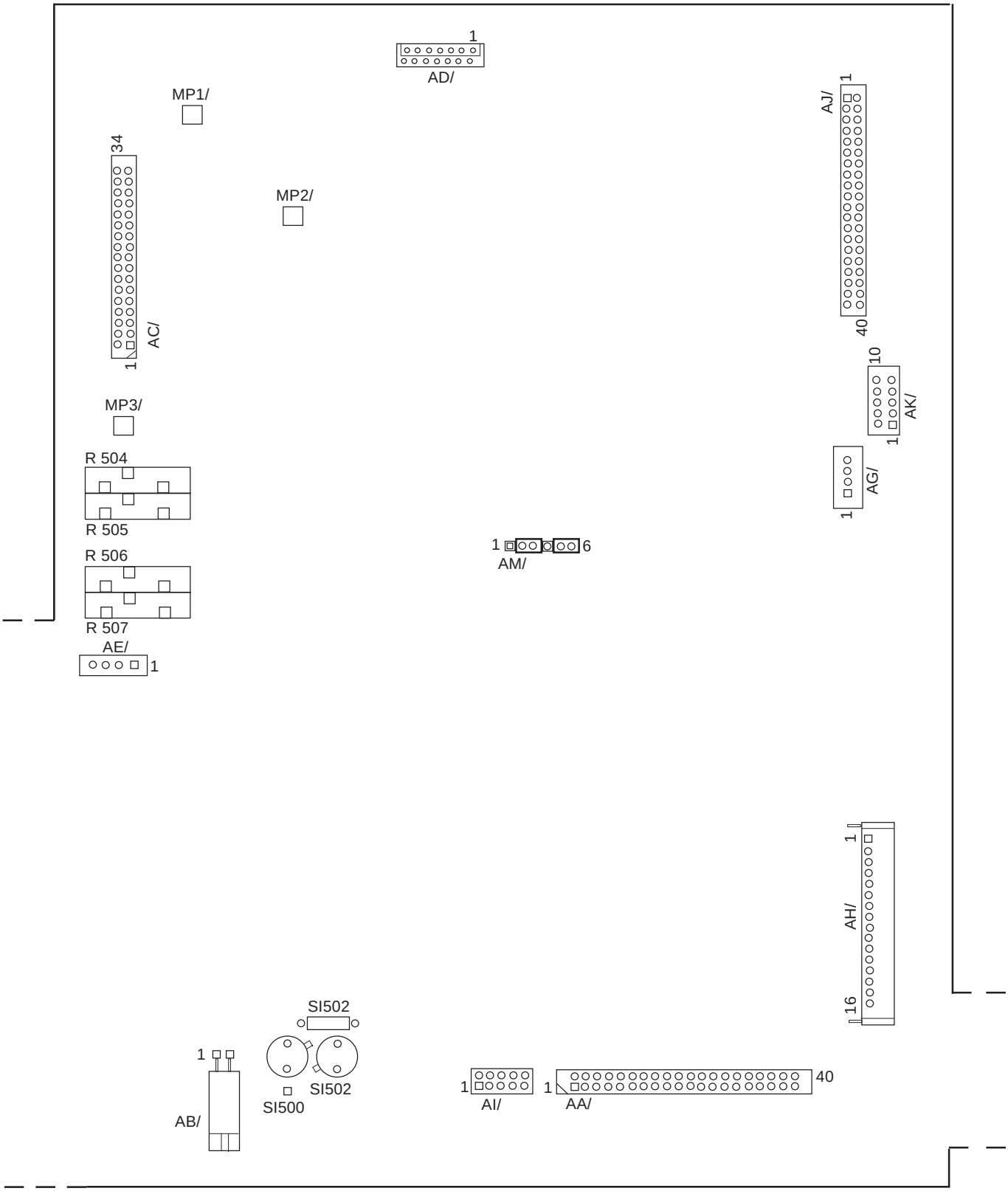
These errors can occur in combination : RAM + ROM : 0012

SpO2

No. 0	“No”	a),	internal, no error
No. 1	“RAM”	b),	MP204, RAM error
No. 2	“ROM”	b),	MP204, ROM error
No. 3	“Data Link”	c),	MP204, serial communication to SpO2 module is defective
No. 4	“Command”	c),	MP204, defective commands from CardioServ to SpO2 module
No. 5	“Value”	c),	MP204, defective values from CardioServ to SpO2 module
No. 6	“Calibration”	e),	MP204, calibration error
No. 7	“Not used”	e),	MP204, SpO2 is in calibration mode
No. 8	“Calibr. request”	c),	MP204, calibration request rejected by SpO2 module
No. 9	“Communication”	c),	MP204, defective commands from CardioServ to SpO2 module
No. 10	“Over-current”	d),	MP204, excessive sensor current identified
No. 11	“Post Aver Time”	e),	internal, Post Average Time (integration time setting not adopted)
No. 12	“Post Aver Time”	e),	internal, Post Average Time (integration time scanning rate not adopted)
No. 13	“Defect”	e),	internal, undefined error

a) no error, everything O.K.
b) SpO2 module no longer functions, replace SpO2 module
c) check connection from main board to the SpO2 module
d) replace sensor or cable and switch CardioServ off and then on again
e) switch CardioServ off and then on again

8. Adjustment Instructions



PCB Digital 388 032 06
PCB Digital 388 032 53

Motor Adjustment on PCB Digital

What to adjust or to check?	What to measure with?	How to activate testing mode?	Where to turn?	How much and exact?	What else to note?
Adjust motor speed under small load (recorder flap open) on stationary motor pinion.	Flash at motor pinion with stroboscope (LED).	1) Call up configuration (Press F1 + F5 simultaneously) 2) Call up key test (Press F3+F4 keys simultaneously) 3) Press Print key Speed selector	Speed selector R 506	Stroboscope frequency = 181.07 Hz When a square wave generator activated by LED is used, a low key ratio should be observed.	Motor should be at room temperature. The testing mode terminates automatically after a few seconds. This can be suppressed by pressing any key.
Adjust motor speed under normal load (recorder flap closed) and small load (recorder flap open) so that there is no difference in RPM.			Compensation adjuster R 505		If the RPM changes after compensation adjustment, this should be corrected once more only with R521.

No Stroboscope Available: Motor Adjustment on PCB Digital

What to adjust or to check?	What to measure with?	How to activate testing mode?	Where to turn?	How much and exact?	What else to note?
Adjust motor speed under small load (recorder flap open wide enough so that paper is just transported)	Remeasure grid printout. min. 200 mm	1) Call up configuration (Press F1 + F5 simultaneously) 2) Call up key test (Press F3+F4 keys simultaneously) 3) Press Print key	Speed selector R506	< 1%	Motor should be at room temperature. The testing mode terminates automatically after a few seconds. This can be suppressed by pressing any key.
Adjust motor speed under normal load (recorder flap closed)			Compensation adjuster R505		The adjust-procedure is complete when the RPM is 25 mm/s under small load and normal load.

Heating Time Adjustment on PCB Digital

What to adjust or to check?	What to measure with?	How to activate testing mode?	Where to turn?	How much and exact?	What else to note?
Heating time	Connect oscilloscope to MP2/1 and MP1/1 (GND)	Press Print key in main menu	Heating time adjuster R507	500µs +/- 1% referred to 22°C printhead temperature	Adjustment ensues at 25 mm/s. Important: printhead warms up during printing

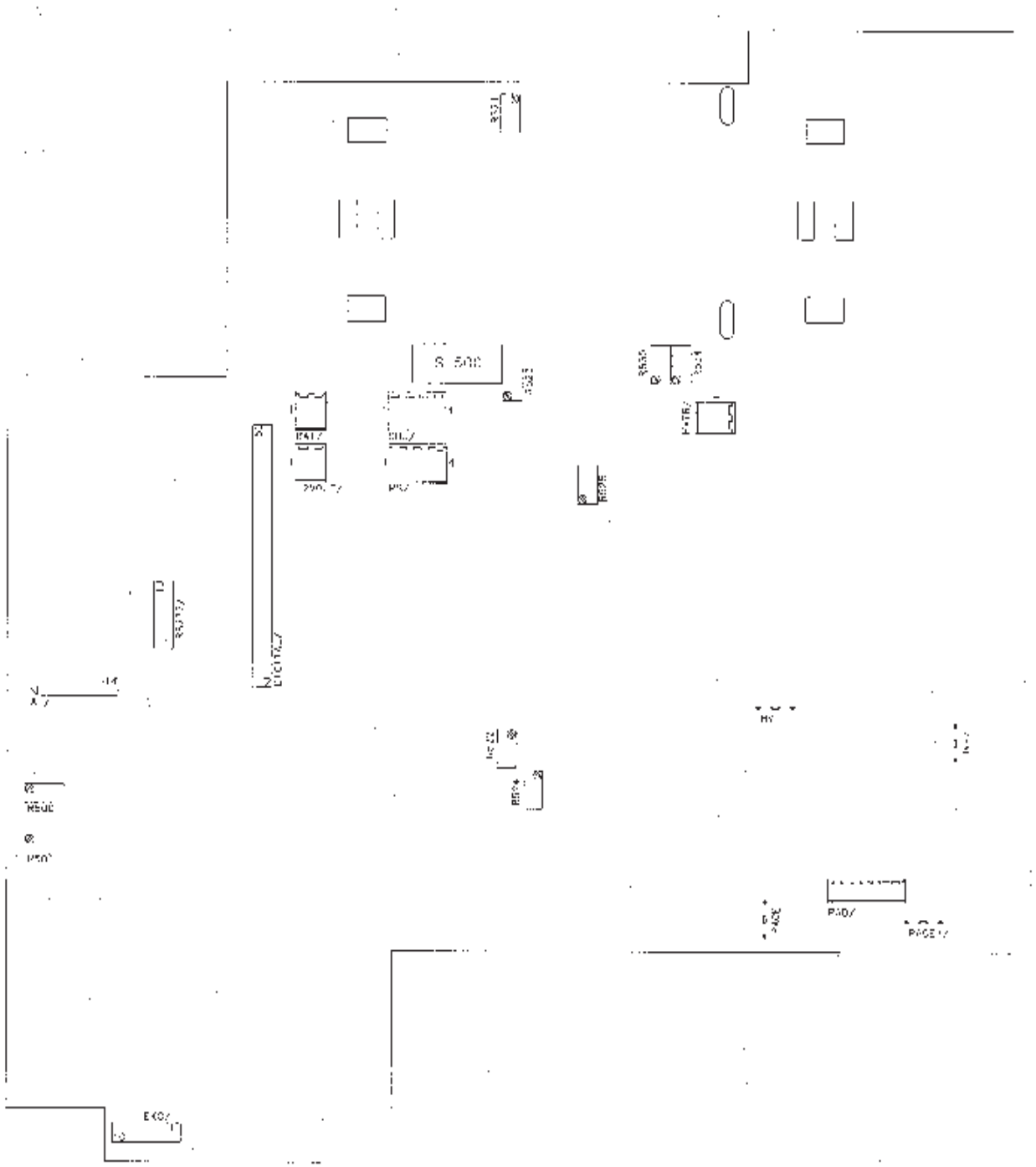
5-V Overvoltage Cutoff Threshold on PCB Digital

What to adjust or to check?	What to measure with?	How to activate testing mode?	Where to turn?	How much and exact?	What else to note?
5-V power supply monitoring	Voltmeter. Input impedance >= 1MOhm	Between MP3/1 and GND	R504	2,720V <1%	

Control of the Power Supply Voltages on PCB Digital

What to adjust or to check?	What to measure with?	Where to measure?	How much and exact?	What else to note?
5-V power supply	Voltmeter.	Between +5V and GND	5,0V +/-2%	
+22-V power supply	Voltmeter.	Between +22V and GND (C504)	+22V +/-5%	Recorder stationary
-23-V power supply	Voltmeter.	between -23V and GND	-23V +/-5%	

PCB Analog



PCB Analog	303 445	(for Service)
PCB Analog	388 028 10R	(for Production)

Important Notice for Energy adjustmend on Pcb.Analog

In order to represent the actual charged Energy on the Display of the CardioServ, it is necessary to activate the following function .

1. Press together the key F1 and F 5 ⇒ the Function < Unit Configuration > is active
2. Press together the key F3 and F 4 ⇒ the Function < Key t -Test > is active
3. Press any key on the key pad
4. Press together the key F3 and F 4 ⇒ leave the Function < Key t -Test >

Now the Energy adjustment may to be started.

Note: In user mode the selected Energy is displayed within the allowed tolerance.

Energy Adjustment on PCB Analog

What to adjust or to check?	What to measure with?	How to activate testing mode?	Where to turn?	How much and exact?	What else to note?
Energy released in 50-ohm resistor	Defi tester		R534	100J +-2J	Turn R508 left to minimum. Selector switch to 100J Defibrillate in Defi tester
Adjust charging time	Timer		R525	8s	Starting from the left adjust R512 Selector switch to 360J Defibrillate in Defi tester
Adjust display of energy to be released in 50-ohm resistor	Defi tester	Check screen display	R521	Energy displayed in Defi tester +-2J	Selector switch to 100J Defibrillate in Defi tester
Adjust display of energy released	Defi tester	Check screen display (50 ohms)	R523	Energy displayed in Defi tester +-2J	Selector switch to 100J Defibrillate in Defi tester
Safety cut-off			R520	Attention! Do not alter	Safety cut-off adjustment in factory only
Check all energy levels	Defi tester		R534, R521, R523	Selected energy level +-5% or 2J Higher value permissible	Adjust all energy levels on energy selector switch. If required, correct previous settings

EC Amplifier Adjustment on PCB Analog

What to adjust or to check?	What to measure with?	How to activate testing mode?	Where to turn?	How much and exact?	What else to note?
Offset EC amplifier cable	Optical scale	Display	R501	Baseline offset < 1 mm	Toggle amplification between 0.5, 1 and 2
Amplification EC amplifier cable	Optical scale	Printer	R500	10 mm +-0.5 mm	ECG pickup 1 mV
Offset EC amplifier paddles	Optical scale	Display	R524	Baseline offset < 1 mm	Toggle amplifi-cation between 0.5, 1 and 2
Amplification EC amplifier paddles	Optical scale	Printer	R522	10 mm +- 0.5 mm Connect ECG pickup with paddles Amplitude 1 mV	

9. Technical Specifications CardioServ/CardioServ VF

The "Technical Specifications" section describes the technical data of the device valid at the time of printing.

Operating modes

* manual (non-synchronized, synchronized)
* semiautomatic (VF)
* semiautomatic/button (VF)
* semiautomatic/dongle (VF)

Energy selection

adjustable, energy to be delivered into 50 ohms displayed digitally

* selectable energy levels, energy to be delivered into a 50-ohm resistance (max. energy of 50 joules for internal defibrillation):
  2
  5
  7
  10
  20
  30
  50
  100
  150
  200
  300
  360 joules
* possible deviation from selected energy below values specified by IEC

Energy storage

by means of capacitor, capacitor is charged from battery, from a 12-volt power source (emergency vehicle) or from the power line (95 to 240 V; 49 to 65 Hz); when capacitor charging is terminated buzzer sounds:

* capacitor charging time for energy setting of 360 J:
  – from power line: typically 8 s
  – from fully charged battery: typically 8 s
  – from partially discharged battery: typically 10 s (15 s max.),
  measured at least 5 minutes after 15 shocks of 360 joules each
  (for 200 joules typically 4 s)

Defibrillation shock
capacitor discharge via induction coil (damped serial resonant circuit), pulse shape = a sinusoidal halfwave with decay period:
* pulse duration for an external resistance of 50 ohms approx. 4 ms, measured from the beginning of the pulse to the intersection of the zero line and the inflection point of the trailing pulse edge
* in synchronized mode the defibrillation shock is released within 30 ms of the R-wave trigger

Discharge circuit
serial oscillating circuit in series with external resistance (patient):
* capacitance 32 µF
* inductance 26 mH
* equivalent resistance 6.5 ohms

Pulse output
isolated, no conductive connection with enclosure, open-circuit and short-circuit-proof
* isolation test voltage 8 kV DC, type CF according to IEC requirements

Safety discharge
capacitor discharge via internal load resistance:
* when the defibrillation shock is not triggered within 30 s after charging
* when the defibrillation shock is triggered, but the discharge circuit is interrupted, after approx. 0.2 s
* immediately when reducing the selected energy during or after charging
* when the selected energy is not reached, after 32 s
* in the event of technical malfunctions

Test features
* pilot lamp for battery charging
* defibrillator test by discharging the stored energy into the internal 50-ohm load resistance; 3-digit display of the delivered energy
* warning on LCD when discharge circuit is interrupted (e.g., defibrillation paddle not applied)
* automatic defibrillator test on power up with display of error message, if applicable

Synchronization
with ECG signal of either polarity:
* min. ECG amplitude for reliable triggering approx. 0.5 mV with QRS duration of 80 ms

ECG signal input via paddles
ECG signal acquisition via defibrillator paddles, ECG trace displayed on LCD, automatic switching to ECG electrodes when patient cable is connected; cardioversion both via ECG patient cable and via paddles; differential input; isolated, class CF according to IEC, with overvoltage protection

* input voltage range ±4 mV
* input impedance >1.5 Mohm
* max. polarization voltage ±1V
* frequency response 2.2 Hz to 20 Hz (-3 dB)
* common-mode rejection >80 dB
* patient leakage current: in normal condition <10 µA, in single-fault condition <50 µA
* detection of pacing pulses
  – pulse duration d_p >approx. 0.1 ms <2.0 ms
  – pace marker independent of polarity
  – pulse amplitude a_p ±20 to ±700 mV
  – reverse-current pulse a_0 ±1 mV
  – time constant t_0 = 25 to 100 ms

ECG signal input via patient cable
via ECG electrodes, automatic switching to ECG electrodes when patient cable is connected; cardioversion both via ECG electrodes and via paddles; differential input, symmetrically referred to N, isolated, class CF according to IEC; 7 standard leads selectable via lead selector; input with overvoltage protection (defibrillation-proof):

* input voltage range ±4.4 mV for recorder,
  ±4 mV for display
* input impedance >2.5 Mohm for 10 Hz
* common-mode dynamic range ±3 V
* differential DC voltage compatibility ±1 V
* common-mode rejection (CMRR) R,L referred to N 65 dB, N referred to chassis >110 dB
* QRS trigger (measured according to AAMI EC 13): trigger threshold 0.3 mV (for QRS widths between 40 ms and 70 ms and between 30 and 250 BPM)
* bandwidth .5 to 100 Hz
* patient leakage current: in normal condition <10 µA, in single-fault condition <50 µA
* ground leakage current: in normal condition .5 mA, in single-fault condition 1 mA
* voltage resistance referred to circuit reference 4 kV

* detection of pacing pulses
  – pulse duration d_p >approx. 0.1 ms <2.0 ms
  – pace marker independent of polarity
  – pulse amplitude a_p ±20 to ±700 mV
  – reverse-current pulse a_0 ±1 mV
  – time constant t_0 = 25 to 100 ms

Signal display
backlit LCD, 2-channel erase bar mode, calibration pulse in left-hand corner (for ECG) alphanumeric presentation of alarm messages, sensitivity, leads, systole blinker, alarm limits, heart rate, energy and softkey labels
ECG freeze with simultaneous display of the current ECG and (for units with SpO_2 function) plethysmogram at a smaller scale
ECG trace 1.5 times larger than on recording: with a sensitivity of 1 cm/mV a 1-mV signal has an amplitude of 1.5 cm on the display
* erase bar sweep speed 25 mm/s
* trace length in real-time mode 4.6 s
* display dimensions: 115 mm wide, 86 mm high
* resolution 320 x 240 pixels (pitch of .36 x .36 mm)
* displayed image can be rotated 180°

Signal transmission
signal input —> amplification —> signal sampling —> AD conversion —> digital processing —> LCD and recorder
* selectable sensitivity: .5-1-2 cm/mV (with max. sensitivity of 2 cm/mV a 1-mV input signal is 2 cm in amplitude on the recorder and about 3 cm on the LCD), amplitude limited to approx. ±2 cm on the recorder and approx. ±3 cm on the LCD
* signal sampling rate 1000 Hz at mains frequency of 50 Hz, 1200 Hz at mains frequency of 60 Hz

ECG signal output (“Option” port)
* ECG lead shown on display
* 1 V output signal for 1 mV input signal (at 1 cm/mV)
* U_{max} ±2 V
* overall error < 3% (typical)
* R_L 500 W min.
* delay < 150 ms (not suitable for precise triggering)

9 = ECG
10 = chassis

Systole check

* heart symbol flashing on the LCD
* QRS beep (can be disabled)
* AC line filter 50 Hz (60 Hz); interference elimination
* muscle filter
  low pass filter with f_{lim} = 27 Hz (50 Hz mains)
  f_{lim} = 32 Hz (60 Hz mains)
  cut-off at 83/100 Hz

Heart-rate measurement

derivation of trigger pulses from the ECG of either polarity, adaptive trigger threshold, calculation of the average rate, storage of the result, 3-digit display on LCD, alarm limits to the left of the reading:

* measuring range 15 to 300 BPM
* digit height of HR reading 7.5 mm
* digit height of alarm limits 2.5 mm
* min. amplitude for reliable triggering >.25 mV for ECG signal with a QRS duration of 80 ms

Alarm system

electronic release of alarm

* when the HR violates one of the set limits for at least 5 s: alarm tone sounds (can be disabled), message “Alarm, high HR” or “Alarm, low HR”, recorder starts (if configured)
* when at least one of the selected electrodes drops off: audible signal (if patient cable is plugged in), message “Alarm, Electrode” on display
* alarm limits adjustment range 15 to 300 BPM (not overlapping)
* digit height of alarm limits 2.5 mm
* keys to cancel alarm and to silence alarm tone
* softkeys to adjust alarm limits
* when set up for VF detection running in the background, alarm release can be enabled or disabled

Recording
delayed recording of the ECG stored in the signal memory (strip length 16 s, incl. 4-s history) in the event of an alarm plus alphanumeric annotations on the paper margin:
– heart rate
– lead
– filter
– date
– time
– paper speed
– cause of recording (defib, alarm, manual)
– selected energy
– delivered energy
– sync mark
– text (name of user/hospital/practice)

After the ECG recording, a patient ID sheet is printed indicating name, date of birth, user, comments, date, time, energy and alarm limits.
Direct writing with rectangular coordinates using thermorecording technology (printhead with electronically controlled thermal elements records on thermosensitive paper), baseline fixed at the center of the space available for recording of the ECG trace, grid imprint, roll paper, paper transport by electronically controlled DC motor, limited duration of transport

* number of recording channels 2
* paper width 55 mm
* roll diameter 60 mm max. (roll with 40 m of Marquette Hellige CONTRAST®)
* printhead resolution vertical 6 dots/mm, horizontal 24 dots/mm
* paper speed 25 mm/s ±5%
* paper transport after both manual and automatic start 16 s (incl. history of 4 s after automatic recorder start)

To prevent damage to the printhead, use only the original Marquette Hellige CONTRAST® chart paper.

Memory
* storage of 40 ECG strips initiated by defibrillation or alarm with a length of 16 seconds and a history of 4 seconds each, incl. a full report
* storage of the 80 most recent actions (e.g., power on, power off, alarms, defibrillation energy) incl. date and time

SpO_2

* saturation: 0 to 100 %, in 1-% increments
* frequency: 0 to 250 BPM, in 1-BPM increments
* alarm limit: off, 15 to 100 %
* display of plethysmogram
* C-LOCK ECG synchronization
* integration time: 4, 8 and 12 seconds
* measuring accuracy: 70 to 100% ±2 digits
  50 to 69% ±3 digits
  pulse display 1.2% or ±1 BPM

Pacemaker

* operating modes: demand, fixed-rate
* pacing rate: 30 to 180 BPM
* pacing current: 0 to 200 mA (for 500 Ohms),
  voltage up to 120 V
* pulse width: 40 ms
  20 ms (for pacing rate of 155 BPM and higher)
* pulse shape: monophase square-wave pulse
* error message “Check Electrode” when pacer output differs from set value (±20% or ±20 mA)

Power

from the power line

* 95 V to 240 V, 49 Hz to 65 Hz
* power consumption at 230 V
  – during monitoring 160 mA
  – during capacitor charging 750 mA
* from a 12-Volt power source of the emergency vehicle
* from exchangeable, rechargeable NiCd batteries
* rated voltage 12 V
* rated capacity 1.4 Ah
* battery is charged while inserted in the unit
* charging time for depleted battery approx. 16 hours

* operating time with a fully charged battery approx. 35 defibrillation shocks of 360 joules each (into 50 ohms) or 2 hours of monitor operation (1.2 hours with pacemaker and SpO_2 measuring system)

Operational readiness
4 s after power up (incl. automatic selftest)

Operating position
any

Environment

Operation

under the following conditions regarded as normal:
* temperature between 0 and +40 °C
* rel. humidity between 30 and 95%, no condensation
* atmospheric pressure between 700 and 1060 hPa

Storage and transport
* temperature between -20 and +60 °C
* rel. humidity between 10 and 95%, no condensation
* atmospheric pressure between 500 and 1060 hPa

Dimensions
* width 432 mm
* height 172 mm
* depth 377 mm

Weight
* approx. 8 kg (incl. battery)

10. Maintenance and Technical Inspection

Technical Inspections

Testing the operating and functional safety of the CardioServ is carried out according to the checklists below.
They serve the experienced technician when inspecting the instrument. A knowledge of how to operate the CardioServ in compliance with the operator's manual is assumed.

The tests are based on the calibration devices described below. Where possible, the tests should be conducted using the customer's accessories to also detect any defective accessories automatically.
Using calibration devices other than those named below may require changes in the tests and tolerance specifications.

10.1 General Information

The CardioServ is an instrument with an internal power source assigned to Protection Class I and Class IIb (MPG).
The instrument is suitable for external and internal defibrillation (as well as cardioversion).
The heart rate is monitored with configurable alarm limits. Upgrade options include a transcutaneous pacemaker and / or SPO2 calibration module; the latter can also be monitored.

In addition, the CardioServ VF has the following operating modes:
- manual
- semi-automatic with the option to switch over to "manual" by pressing a key
- semi-automatic with the option to switch over to "manual" with the help of an encoding module
- as a semi-automatic instrument

Caution!

CardioServ uses high voltage. The inspection should be referred to independent persons with adequate training and experience.
These inspections must be carried at least **once a year**.

10.2 Testing Equipment

ECG simulator	
Defitester	
Safety tester, e.g., NSE	
1X SPO2 simulator	408 610-001
1X SPO2 SpO2 sim. Hellige circular power cord connector	223 417 01
1X Finger probe	701 240 21
1X Power cord for SpO2 sensor	303 443 58
Test adapter to measure pacing pulses	220 101 01
Dongle	303 445 15

Recommended Test Equipment

- Safety Tester for measurements according to IEC 601.
- Testing connector according to the following drawings.

Testing connector for measuring patient leakage current

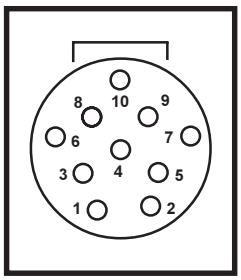
The following wiring of testing connectors is recommended for the technical inspection of module input type BF (body floating) and type CF (cardiac floating).
The catalog numbers of the Marquette Hellige components are given below.

When making the connectors observe the following configurations:
The diagrams of the plug inserts in this document are always as viewed from the inside of the connector shell.

- Testing connector for the temperature input

1 x	2-pin jack plug	91530000
1 x	Telephone socket or matching isolated plug connection for testing case	91534800

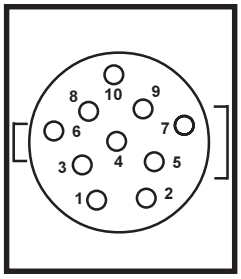
The two jack plug poles are short-circuited with one another and connected to the telephone socket.



- Testing connector for ECG input

1*	Connector	91541378
10*	Contact pins	91541394
1*	Telephone socket or matching isolated plug connection for testing case	91534800

Short-circuit all 10 contact pins with one another and connect to telephone socket.



- Testing connector for SaO2 input

1*	Connector	91541871
7*	Contact pins	91541394
1 *	Telephone socket or matching isolated plug connection for testing case	91534800
6*	10 kohm resistor	92184443

Connect pin 10 directly to the telephone socket.
Connect pins 1,4,5,6,7,9 via 10 kohm resistor to telephone socket.

Measure patient leakage current on the Defi electrodes

The patient leakage current on the Defi electrodes is measured directly on each paddle.

10.3 Visual Check

Test instrument and accessories to ensure that
- fuse links have the rating proclaimed by the manufacturer
- safety labels and inscriptions on the device are clearly legible
- the mechanical condition will allow the device to be put to further use
- any soiling has no effect on safety of operation.

The defibrillator electrodes as well as handles and holder recesses must be free of any cream residue.

The defibrillator electrodes, pacemaker cable, ECG cable , SPO2 cable and CardioServ power cord should be checked for any visible external damage to the insulation and strain relief.

10.4 Performance Check

10.4.1 Power-up Test

Switch the instrument on with the energy selector switch (turn rotary switch to first position ECG).
A chessboard pattern appears on the display for about 2 seconds. A performance test follows and the software release number is displayed. If the self-test is O.K., no error message appears on the screen. When error message occurs, see page 39 "Error Codes".

10.4.2 Key Test

Press the F1 and F5 keys simultaneously. The configuration screen appears. By pressing the F3 and F4 keys simultaneously the key test screen appears in the self-test mode.
By pressing each key in turn, the function of the keys can be tested. The key pressed appears in the key test screen with its assigned function. This screen also provides self-test information. The self-test screen also shows the software version, its checksum and the results of the CardioServ self-test. The options built into this instrument are displayed alongside the results of the self-test, pacemaker version, VF, date, time and SPO2 version plus error status.

10.4.3 Printer Test

The printer is tested in the standard mode. Check that there is some paper andpress the Print key. A manual printout will then be printed out at 25 mm/s.
Using a ruler check the printout grid. In the event of a deviation, reset the motor speed (for details see p. 42 Motor Adjustment).

10.4.4 Energy Test

Connect defibrillation electrodes to Defi. The paddles must be locked in place in the Defi holders.

Prerequisite for the following test < energy 360 joules in 9 seconds>
The Defi battery must be fully charged or the Defi must be connected to the mains with a power cord.

Switch instrument on. Switch energy selector switch to 360 joules. Energy must be available after approx. 9 seconds. Trigger energy charge operation by pressing the Charge Defi key in the electrode handle.
As soon as the charge operation is complete a beep sounds. Release the defibrilla tion pulse with the **Charge Defi** key and the **Defib** key within the next 30 s.

The values (tolerance range) for the energy released is given in the table below.

If an energy adjustment proves necessary, use the adjustment instructions given in the Servicing Instructions Manual.(Please refer to p 46 Energy Adjustment)

Energy selected	Energy available/released in CardioServ display	Energy released in joulemeter
2	1-3	1-3
5	4-6	4-6
7	6-8	6-8
10	8-12	8-12
20	18-22	18-22
30	28-32	27-33
50	45-55	45-55
70	65-75	63-77
100	95-105	92-108
150	145-155	140-160
200	190-210	188-212
300	290-310	285-315
360	350-370	340-380

10.4.5 Pacemaker Test (Without pacemaker testing adapter)

Caution: During the pacemaker test the energy selector switch may be set to the ECG position only. Do not actuate the Defib and Charge keys.

Connect trunk cable for disposable adhesive defibrillation electrodes Part No. 223 346 01 to the Defi.
Short-circuit middle contacts 2 and 3.

Connect 500 ohm resistor between contacts 1 and 4.

Switch pacemaker on Defi on and select **operating mode Fix**.

Using the +mA ; -mA key select any pulse amperage.

Using the +P/min ; -P/min key select any frequency.

Pulse width Demand, Fix: 40 ms
> 155 P/min 20 ms

Using the oscilloscope measure the drop in voltage across the measuring resistor.

Calculate pulse amperage according to Ohm's Law I = U/R
(Pulse amperage = measured voltage / measuring resistor 500 ohms).

Calculated pulse amperage must correspond to setting in Defi display. Error message "Check electrodes" appears when pulse current deviates from configured value (± 20% or ± 20 mA)

Switch pacemaker on Defi on and select **operating mode Demand**.

Using the +mA ; -mA key select any pulse amperage.

Using the +P/min ; -P/min key select frequency of 60 pulses.

Using the ECG simulator set frequency to below 60 pulses. The pacemaker pulses should be measured as described above.

Using the ECG simulator set frequency to above 60 pulses. In this case the pacemaker will be reset. The pacemaker pulses do not need to be measured.

10.4.6 Pacemaker Test (with Marquette Hellige testing adapter)

The Marquette Hellige testing adapter offers two possibilities for pacemaker testing.

1. Pacing pulse detection via LED
2. Pacing pulse measurement with an oscilloscope.

Caution: During the pacemaker test the energy selector switch may be set to the ECG position only. Do not actuate the Defib and Charge keys.

Connect testing adapter to CardioServ.

Switch pacemaker on Defi on and select **operating mode Fix**.

Using the +mA ; -mA key select any pulse amperage.

Using the +P/min ; -P/min key select any frequency.

Pulse width Demand, Fix: 40 ms
> 155 P/min 20 ms

Using the oscilloscope measure the drop in voltage across the measuring resistor.

Calculate pulse amperage according to Ohm's Law I = U/R
(Pulse amperage = measured voltage / measuring resistor 500 ohms).

Calculated pulse amperage must correspond to setting in Defi display. Error message "Check electrodes" appears when pulse current deviates from configured value (± 20% or ± 20 mA)

Switch pacemaker on Defi on and select **operating mode Demand**.

Using the +mA ; -mA key select any pulse amperage.

Using the +P/min ; -P/min key select frequency of 60 pulses.

Using the ECG simulator set frequency to below 60 pulses. The pacemakerpulses should be measured as described above.

Using the ECG simulator set frequency to above 60 pulses. In this case the pacemaker will be reset. The pacemaker pulses do not need to be measured.

10.4.7 SPO2 Performance Check

Connect SPO2 power cord 701 240 31 to a SPO2 probe on the Defi.
Since there is no affordable SPO2 simulator currently available, the SPO2 test should be performed by the tester himself.
Connect finger probe to test subject (tester). The SPO2 readings and the plethysmogram appear after a few seconds.

Simulator settings

Test the SpO2 parameter with the Marquette SpO2 simulator as follows:
- Switch simulator power switch to off.
- Connect connector cable up between simulator and CardioServ monitor.
- Set SpO2 to 95.5% using the white Nellcor scale.
- Set pulse rate to 100 bpm.
- Select mode on Nellcor.
- Activate power switch.

Monitor settings on CardioServ

Activate pulse frequency display by pressing F5 **(next)**, followed by switching to **(HR Source Pulse)** with F1 **(HR Source Pulse)**.

Displaying waveforms and parameter readings

- A sine wave SpO2 waveform should appear on the screen.
- An SpO2 parameter reading of 92%-95% should be displayed.
- The pulse rate displayed should lie between 96 and 104 bpm.

Testing display accuracy of SpO2 and pulse rate

Check displayed values on the LCD screen using the following simulator settings:

Simulator value SpO2	**Value displayed**
95.5%	92% - 99%
90.6%	87% - 94%
85.5%	82% - 89%

Simulator value pulse rate	**Value displayed**
70 bpm	66 bpm - 74 bpm
100 bpm	96 bpm - 104 bpm
160 bpm	155 bpm - 165 bpm

Activate interference test on the simulator by pressing key and keep it pressed, the SpO2 value must remain displayed on the screen.
Disconnect the SpO2 plug from the monitor. The message “No Sensor” appears, accompanied by an intermittent audible alarm signal, provided the alarm is enabled.
Press **(F4)** button, alarm is silenced.
Connect up finger probe and check it is working correctly.

10.4.8 ECG Test

Connect the electrode cable to the Defi. Use a standard ECG signal generator to generate ECG signals. Use either a 3-lead trunk cable 223 287 01 or a 5-lead trunk cable 223 400 11.
Switch Defi to monitor mode. The ECG and the heart rate adjusted on the ECG simulator appear on the display. The upper and lower limits should be tested to ensure they are enabled. The error messages when electrodes become detached should also be checked. The error message <**Electrode error**> appears on the left-hand side of the display. It is important to ensure that the ECG lead is selected so that the corresponding electrode is tested. In the case of the paddles lead the error message <**Electrode error**> appears on the screen when the paddles are taken out of their holders on the CardioServ.

10.4.9 Cardioversion Test

Connect the electrode cable to the Defi. Use a standard ECG signal generator to generate signals. Use either a 3-lead trunk cable 223 287 01 or a 5-lead trunk cable 223 400 11.

Set energy selector switch to any energy setting. Actuate SYNC key on the Defi. The SYNC function should now appear in the display. Defi paddles are locked into place in the CardioServ holder.
Charge energy by pressing the **Charge Defib** key. After charging is complete actuate Charge **Defib** and **Trigger Defib** keys. Triggering is effected by the Zpeak of the beat. Afterwards, the function Cardioversion is automatically reset.

10. 4.10 Option Socket Input Test

The option socket input can be tested with the dongle No. 303 445 15 in the configuration. If you can enable the operating mode Semi-automatic/Dongle in the configuration (press F1 and F5 keys simultaneously) of semi-automatic defibrillators, this indicates that this function is O.K. Furthermore, the 1-volt ECG signal is still available at this option socket input. With an incoming ECG signal this can be measured with the oscilloscope.

10.5 Battery

A battery charge check can only be performed in the battery service unit Part No. 101 128 01. This tests takes at least 2 hours, max. 3 hours. The service manual for the battery service unit can be ordered under Part No. 227 454 77.

If no battery service unit is available, the battery should be replaced every 2 years.

Battery Maintenance

Proper maintenance of NiCd batteries is essential and considerably promotes their proper performance. Routine preventive maintenance should be carried out by qualified service technicians on a regular basis (recommended interval: 30 days). If batteries are repeatedly partially discharged, the resulting "memory effect" max dramaticaly reduce the battery capacity.
This effect can be efficiently minimzied by regular conditioning. If the capacity of a relatively new battery is drastically reduced, the battery max be reconditioned by repeated charging and discharging.

Monthly Battery Maintenance (Conditioning) and Checks

1. Disconnect CardioServ from the power line and discharge fully charged battery in the monitoring mode. To do so, set energy selector switch to (SpO_2 sensor not connected) and wait until device switches off.

2. Check how long it takes before battery is depleted. If the time is less than 1.8 hours, the battery is too old or improperly maintained and should be replaced.

3. Recharge the battery. This will take 16 hours.

Rechargeable batteries require special maintenance and continued checks to assure they function in emergency situations. It is normal for batteries of this type to selfdischarge when not in use.

11. Safety Analysis Test

11.1. General introduction

The suggested Safety Analysis Tests refer to the international standard IEC 601-1.
The tests are generally performed with Safety Testers, on most of them, the measuring circuits according IEC 601 are already implemented.
The following is a general description of the tests to be performed. For the handling of your Safety Tester follow the user manual.

The tests may be performed under normal ambient conditions of temperature, humidity and pressure and with line voltage.
The leakage currents correspond to 110 % of rated voltage for the tested unit. Most Safety Testers take this into account,
otherwise the measured values have to be calculated.

11.2 Recommended Test Equipment

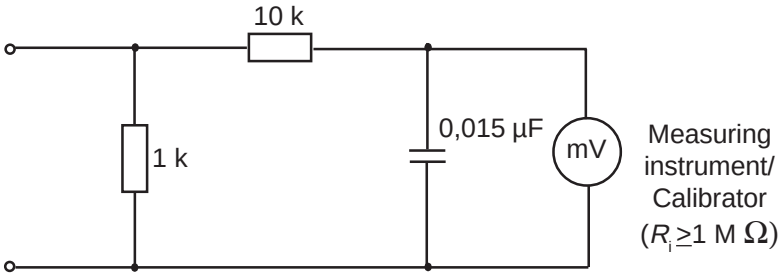
- Safety Tester for measurements according to IEC 601.
- Testing connector according to the following description.

11.3 Protective Earth Resistance Test

The power cord is to be included in the protective earth resistance test.
This test determines whether the device has a power ground fault.
- The protective earth resistance from power connector to any protective earth connected exposed conductive part is measured.
- Specs. of test circuit: AC current source 50 Hz/60 Hz of at least 10 A up to 25 A with limited output voltage of 6 V.
- If resistance is greater than 100 mOhm, the unit fails this test.

11.3.1 Leakage Current Measurement

To perform the suggested measurements, the unit under test has to be separated from any interconnection to a system. If the unit is part of a system, extended tests according to IEC 601-1-1 have to be performed. The following diagram shows the
Measuring Circuit [M] required for leakage current. The reading in mV corresponds to µA (leakage current). The Safety Testers generally work with this Measuring Circuit [M] and the displayed values are already converted to leakage current.



11.3.2 Enclosure Leakage Current Test

This test is performed to measure leakage current from chassis to ground during normal conditions (N.C.) and single fault conditions (S.F.C.).
In all cases, the leakage current is measured from any exposed conductive parts to ground, the unit under test has to be switched on and off.

Connect the unit under test to your Safety Tester.

- During normal conditions (N.C.), referring to the electrical diagram, measurements have to be done under the following conditions:

*	Polarity switch	Norm and RVS
*	GND switch	GND closed
*	S1	closed and open

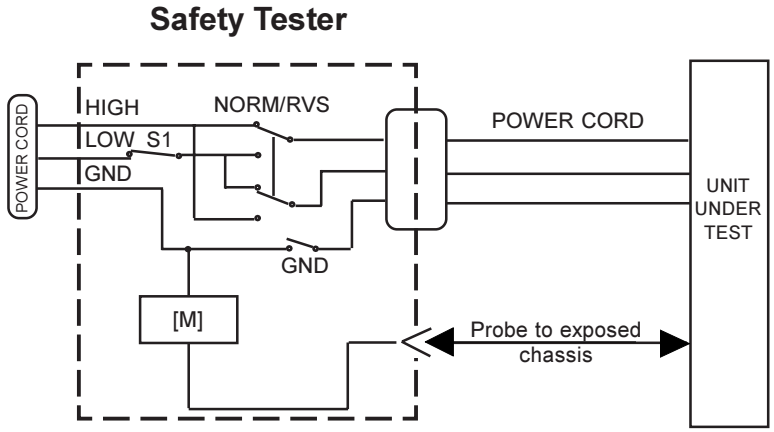
- During single fault conditions (S.F.C.), referring to the electrical diagram, the measurements have to be done under the following conditions:

* Polarity switch NORM and RVS
* GND switch GND open
* S1 closed

Test has failed if the measured values are greater than:

N.C.	S.F.C
100 µA	500 µA
	300 µA (U.L. requirements)

Electrical Diagram for Enclosure Leakage Current Test



11.3.3 Patient Leakage Current Test

This test performs a leakage current test under single fault conditions (S.F.C.) depending on domestic power outlet with 115 or 230 V AC as source into the floating inputs.

The following signals have a separate floating input and have to be tested separately.

ECG from ECG Input socket
ECG from Paddels
SPO_2

In all cases, the leakage current is measured from input jack of unit under test to ground. The measurement ground point is the left-hand contact on the underside of the CardioServ.

For testing the floating ECG input ,a patient cable, with all leads connected together, is used.

For testing the floating input from Paddles, the test is measured on each Defipaddles.

For testing the floating input from SPO_2 , test plugs are used.

Connect the unit under test to your Safety Tester.

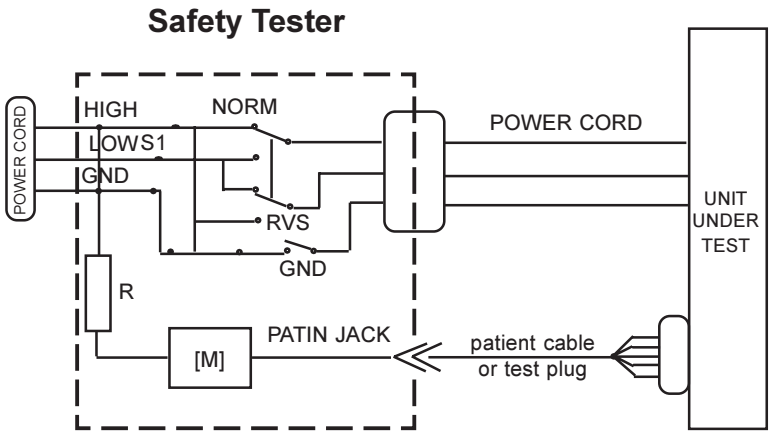
- Referring to the electrical diagram, measurements have to be done under the following conditions:

* Polarity switch NORM and RVS
* GND switch GND closed
* S1 closed

Test has failed if the measured values are greater than **50** µ**A** at ECG Input and SPO2 Input.

Test has failed if the measured values are greater than **100** µ**A** at Defipaddles.

Electrical Diagram for Patient Leakage Current Test



For protection of the test person, the following values of resistor R may be used:

Typ BF	22 kOhm (120 to 130 V)
	47 kOhm (220 to 240 V)
Typ CF	100 kOhm (220 to 240 V)

12. Spare Parts Lists

CardioServ VF Version 4.x
CardioServ Version 4.x

Operation Manuals

227 453 03	Servicing Instructions	
227 446 21	Operating Manual german	CardioServ VF
227 446 22	Operating Manual engl.	CardioServ VF
227 446 23	Operating Manual fren.	CardioServ VF
227 446 25	Operating Manual ital.	CardioServ VF
227 446 26	Operating Manual span.	CardioServ VF
227 446 28	Operating Manual russ.	CardioServ VF
227 446 29	Operating Manual ital.	Esaote VF

Defi Paddles

217 304 03	Defibrillation Electrode, external, with recorder start, for CardioServ
217 308 01	Electrode Lead f.Defi-El.“internal“ without contact insert, for SCP 913
926 074 97	Handle

Keypads VF

390 001 52	Keypad with Pacemaker ESAOTE/international
390 001 68	Keypad without pacemaker ESAOTE/international
390 001 62	Keypad with pacemaker USA
390 001 69	Keypad without pacemaker USA

Keypads manual

390 001 56	Keypad without pacemaker, international
390 001 57	Keypad with pacemaker, international
390 001 58	Keypad without pacemaker ESAOTE
390 001 59	Keypad with pacemaker ESAOTE
390 001 60	Keypad without pacemaker USA
390 001 61	Keypad with pacemaker USA

Recorder

384 015 81	Exchange Recorder preman. f. CardioServ
303 439 76	Thermal printhead
303 434 78	Transportation roller
918 083 49	Motor 18 V~

480 159 46	Gear 10 mm diameter
480 159 47	Gear 24 mm diameter
480 159 48	Gear 40 mm diameter
388 010 56	Pcb. Motor
432 522 30	Flap, Recorder
430 517 84	Sticker in Flap

Printed circuit boards for Version 4.x

303 445 43	Pcb. Analog	(389 004 22)
389 004 22	Exchange Pcb. Analog	(303 445 43)
388 032 53	Pcb.Digital without pacemaker	(389 004 22)
389 004 26	Exchange Pcb.Digital without pacemaker	(388 032 53)
388 032 06	Pcb.Digital with pacemaker	(389 004 26)
389 004 25	Exchange Pcb.Digital with pacemaker	(388 032 06)
930 117 26	Pcb. SPO2	
303 445 32	Speaker	
903 449 88	Capacitor	

Housing

303 445 14	Upper shell VF
303 445 22	Upper shell USA VF
430 519 28	Sticker operation information englih
430 519 29	Sticker operation information french
430 519 30	Sticker operation information italia
430 519 31	Sticker operation information spanish
430 519 32	Sticker operation information russian
303 442 85	Upper shell
303 443 61	Upper shell Esaote
303 444 46	Upper shell USA
430 517 93	Sticker „operation information“, engl
430 517 94	Sticker „operation information“, fren
430 518 09	Sticker „operation information“, ital
430 518 10	Sticker „operation information“ spani
430 518 11	Sticker „operation information“ russi
432 522 08	Lower Shell
430 518 05	Sticker „Attention, high voltage...“
430 518 06	Sticker „Attention, high voltage“...
430 518 07	Sticker „Attention, high voltage...“
430 518 12	Sticker „Attention high voltage...“

430 518 13	Sticker „Attention high voltage...“
430 518 14	Sticker „Attention high voltage...“
504 657 54	Contact —> Station
432 522 27	latch
432 522 35	Filler Plug
924 017 22	Foot
482 035 19	Knob for energy selector
482 035 21	Knob for energy selector (Esaote)
923 096 69	Mounting Base
829 074 11	Scotch mount, white

In-/Output connector

303 442 99	ECG Inputconnector completely wired for CardioServ
303 443 57	SPO2 Inputconnector kompletely wired for CardioServ
303 445 17	Inputconnector option Dongle
303 444 16	Electrode coupling for paddles
915 417 95	Mains plug, 3 wire
303 444 22	Charge Socket for 12 V (Option)
841 202 28	Screw
803 083 02	Nut
804 177 06	Washer

Power supply

930 117 97	Switching power supplies
908 122 28	Fuse block
912 084 53	Fuse fast 5.0A UL
303 440 30	Battery Pack for SCP 910/913/915/922 12 V / 1,2 Ah

LCD Display

930 117 17	LCD Graphic Display

Ambulance Holder for CardioServ

504 658 18	Case
504 658 21	Insulating Device
416 118 28	CONTACT SPRING
504 658 23	Recording Upper
427 338 70	BOLT
504 658 22	Recording Lower
504 658 20	Handle

402 236 14	SOCKET
914 326 43	Pushbuttom switch
427 338 69	ROD
388 011 38	Pcb. 12 V- option

13. Accessories: Car holder

CardioServ Car-Holder 202 307 01

The car-holder secures the CardioServ during ambulance transport. In this holder the CardioServ is supplied with power from the 12-volt ambulance power supply system.

CardioServ Wall Holder 202 307 02

The wall holder secures the CardioServ when not in use. It is identical to the car-holder, except that it does not have any electronics to charge the battery or supply power to the device.

CardioServ Charging Unit 205 106 01

The charging unit serves to supply power in the CardioServ during vehicle transport. The CardioServ is supplied with power from the 12-volt vehicle power supply system. Using this charging unit requires equipping the CardioServ with the charging socket 303 444 22.

Installation Instructions for the CardioServ Mounting System 202 307 01

* First of all, connect the mounting system to the 12-V power supply system of the ambulance (cable aperture on the underside of the mounting system, see terminal diagram).

* Connect the positive terminal (+12 V) to the free contact of the fuse holder (4.8-mm sleeve enclosed).
  Connect earth (0 V) to the corresponding contact of the terminal block (4.8-mm sleeve enclosed).
  Please use the enclosed adhesive fastening base and the cable tie to fix the connection cables.

  Observe the following points when connecting the mounting system:
  - the negative terminal of the ambulance power supply must be connected to earth,
  - the positive lead must be protected with a 10 Amp fuse (slow blow) and
  - the lead diameter must be adequate.

* The mounting system has 4 bore holes both at the top and bottom edges, allowing it to be mounted to the ambulance in a vertical or horizontal position (take care that the mounting system is flush against the wall of ambulance; in the vertical position the wider part with the cable aperture must face down!) (see Fig. 1).

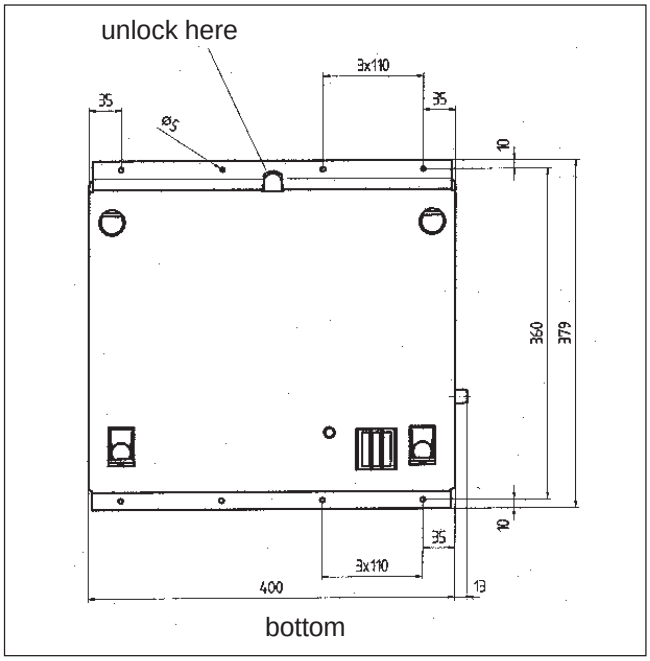


Figure 1

* Replace the 4 rubber feet of **CardioServ** with the metal feet enclosed. When screwing down the metal feet, please note that they have a recess on one side for the screw head.

* Use the appropriate type of screws for attachment of the metal feet: If the CardioServ unit is equipped with metal bushings, please use the fillister head screws DIN 912 M 4 x 12; if there is no metal bushing but only a hole, please use Plastite screws 4 x 16.

* Please be sure to use the red feet (angular groove) at the bottom, i.e., on the side with the contacts. (See Fig. 2).

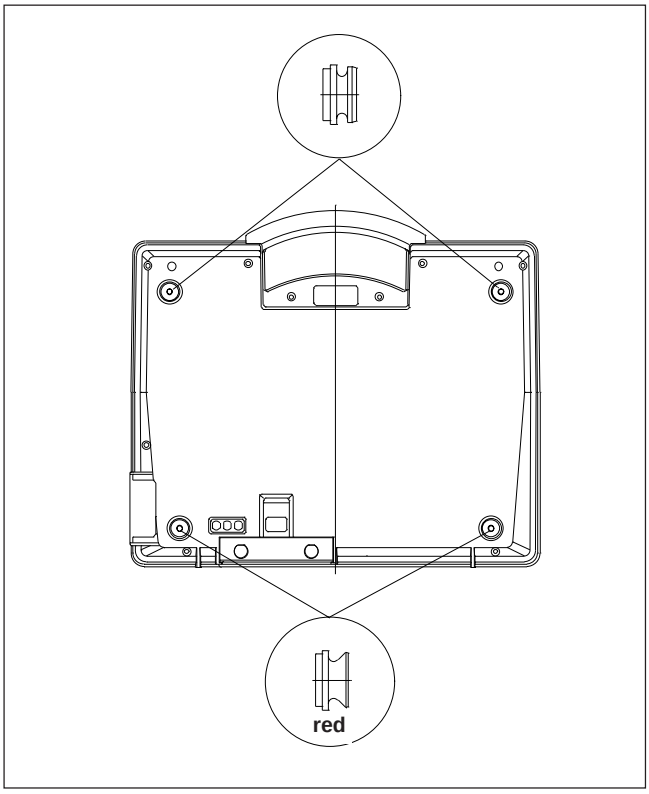


Figure 2

* If required, you may attach the enclosed rubber feet on top of the metal feet.

* Mount the **CardioServ** by first inserting the feet at the bottom, then by introducing the feet at the top.

* To remove the device press on the latches (top center).

Schutzvermerk nach DIN 34 beachten

E - F

504 657 29
432 522 35
923 096 81

G - H

432 522 26

h 430 518 67 nur in/only in 101 117 09,11...13,25...28
siehe Beschilderungsblatt
see labels catalog

927 229 02
siehe Beschilderungsblatt
see labels catalog

WARNING- Hazardous

Ansicht von V
view of V

j 3,5A / 250V

C - D

432 522 27
415 154 90

Ansicht von X
view of X

927 229 02
siehe Beschilderungsblatt
see labels catalog

Z 5:1

415 154 91
504 655 15
B 3 DIN 127 (804 177 18)
3,2 DIN 125 (804 032 00)
M3x6 DIN 7985 (801 776 31)
432 520 25
geklebt
glued
504 655 14

M3x6 DIN 7985 (801 776 31)
B 3 DIN 127 (804 177 18)

h 923 081 00
923 096 69

Ansicht ohne Oberschale
view without upper shell

M3x8 DIN 7985 (801 776 40)
3,2 DIN 125 (804 032 00)

Y
2:1

916 090 00 nur in/only in 101 117 04,05,07,08,12,13 23,24,27,28,31,32
an PIN 10 gelötet h

388 032 05
M3x6 DIN 7985 (801 776 31)
M3x8 DIN 7985 (801 776 40)

923 081 00
923 096 69
929 166 33

923 096 83
915 413 21

915 417 95
3x10 Senkk. Plastite
(801 777 00)

432 522 08
M4x25 DIN 7985
(801 776 63)

M2,5x6 DIN 7985 (801 776 49)
M2,5 DIN 934 (803 083 02)

j 930 117 97
3x8 Linsenk. Plastite
(801 776 96)

M4x5 DIN 7985 (801 776 60)

j 928 056 68
auf 35,2 mm gekürzt

j 829 074 11
35mm lang

h 1) 930 117 26
504 658 62
504 658 63

303 445 17

h 3) 303 445 39
303 445 38

923 096 80

821 103 16
1500mm lang

924 017 22

303 440 30

504 657 54
M3x6 DIN 7985
(801 776 31)

303 442 85
303 443 61
303 444 46
303 445 14
303 445 22
303 445 46
4) h

930 117 17
M3x6 DIN 7985 (801 776 31)

927 229 71

390 001 56
390 001 57
390 001 58
390 001 59
390 001 60
390 001 61
390 001 52
390 001 62
390 001 68
390 001 69
5) h

482 035 19 nur in/only in 101 117 02,06...08
482 035 21 nur in/only in 101 117 01,03...05,09...13,21..32

804 177 15
432 520 08

927 230 39
j
423 203 43

423 203 31
zwischen Lpl und Abschirmblech
auf Blech geklebt
423 203 32
zwischen Lpl und Abschirmblech
auf Blech geklebt

2) h

0 - P

432 519 81

504 657 28
M3x6 DIN 7985 (801 776 31)

923 096 82

432 522 25

217 304 03 nur in/only in 101 117 01,03...05,10
217 304 04 nur in/only in 101 117 02,06...08

A - B

Z

X

Y

O

E

F

G

H

P

V

M

N

504 657 30
M3x6 DIN 7985 (801 776 31)

303 444 16

A

B

C

D

Typenschild
Name plate
siehe Beschilderungsblatt
see labels catalog

MARQUETTE ELECTRONICS
MILWAUKEE WI USA

WARNING For continued protection
DOUBLE INSULATION
CAUTION

Use Battery Cat. No. 303 440 30
only !
Utiliser uniquement la batterie
no de réf. 303 440 30 !
Usare esclusivamente la batteria
art. no. 303 440 30 !

Nur Batterie Best. Nr. 303 440 30
verwenden !

M - N

908 122 28
M3x8 DIN 7985

912 084 53

923 081 00

923 096 69

927 229 02
siehe Beschilderungsblatt
see labels catalog

h
F 5A / 250V
7±1
3±1
30±2
55±2 h

Litze so kurz wie möglich abbinden
the wire after the fixing to be as short as possible

Ansicht von W
view of W

h 430 518 05 deutsch
nur in/only in 101 117 01,03...05,21..24
siehe Beschilderungsblatt
see labels catalog

HINWEIS
VORSICHT HOCHSPANNUNGSGERÄT
Nur von eingewiesenem Fachpersonal zu bedienen
EXPLOSIONSGEFAHR bei Verwendung des Gerätes
im Umfeld von brennbaren Gasgemischen, sowie
Anästhesie-, Reinigungs- und Benzindämpfen.
TESTSTELLADUNGEN zur Funktions- und Sicherheits-
kontrolle nicht öfter als 5 mal nacheinander ausführen!
KEINE Testentladungen gegen Erde oder Personen
vornehmen!

Vor Defi-Elektrodenwechsel Gerät ausschalten

I - J 2:1

480 159 48
Längsspiel 0,7 +0,1
longitudinal play 0,7 +0,1
2,2 DIN 125 (804 022 00)

925 092 00
Preßsitz in 432 517 33
press-fit in 432 517 33

Greifring G2x0,6
retainer ring G2x0.6
(804 107 00)

480 159 47
Längsspiel 0,7 +0,1
longitudinal play 0,7 +0,1
2,2 DIN 125 (804 022 00)

480 159 46

430 517 84

415 154 77

432 517 33
3x12 Linsenk. Plastite 45
(801 777 08)
B3,2 DIN 9021 (804 121 06)

verzinnt

3±2
6,35

427 338 22
Preßsitz in 432 519 66
press-fit in 432 519 66

427 338 59
2,3 DIN 6799 (804 071 00)

416 118 05

432 517 32

918 083 49
M2x6 DIN 7985

h 430 518 68 nur in/only in 101 117 09,11...13,25...28
siehe Beschilderungsblatt
see labels catalog

B H 1

432 517 35

432 522 30

schwarz ausgelegt
printed in black

K

427 338 24

303 434 78

Kamm-Andruck 7,5N-15N
printhead pressure plate 7,5N-15N

303 439 76

388 010 56

504 648 37

K - L 5:1

925 096 19
genietet
riveted

h		
1)	930 117 26 504 658 62 504 658 63	nur in 101 117 04,05,07,08,12,13 only in 23,24,27,28,31,32
2) i	423 203 31 423 203 32	nur in 101 117 04,05,07,08,12,13 only in 23,24,27,28,31,32
3)	303 445 39	nur in/only in 101 117 04,05,07,08,12,13 23,24,27,28,31,32
4)	303 442 85 303 443 61 303 444 46 303 445 14 303 445 22 303 445 46	nur in/only in 101 117 01,03,04,05,10 nur in/only in 101 117 02,06,07,08 nur in/only in 101 117 09,11,12,13 nur in/only in 101 117 21...24 nur in/only in 101 117 25...28 nur in/only in 101 117 29...32
5)	390 001 56 390 001 57 390 001 58 390 001 59 390 001 60 390 001 61 390 001 52 390 001 62 390 001 68 390 001 69	nur in/only in 101 117 01,04,10 nur in/only in 101 117 03,05 nur in/only in 101 117 02,07 nur in/only in 101 117 06,08 nur in/only in 101 117 09,12 nur in/only in 101 117 11,13 nur in/nur in 101 117 22,24,30,32 nur in/only in 101 117 26,28 nur in/nur in 101 117 21,23,29,31 nur in/nur in 101 117 25,27

je nach Kundenauftrag beistellen :
to be added depending on order h

430 518 06	englisch	nur in/only in 101 117 01,03...05,21..24
430 518 07	französisch	nur in/only in 101 117 01,03...05,21..24
430 518 12	italienisch	nur in/only in 101 117 01...08,21..24,29...32
430 518 13	spanisch	nur in/only in 101 117 01,03...05,21..24
430 518 14	russisch	nur in/only in 101 117 01,03...05,21..24
430 517 93	englisch	nur in/only in 101 117 01,03...05
430 517 94	französisch	nur in/only in 101 117 01,03...05
430 518 09	italienisch	nur in/only in 101 117 01...08
430 518 10	spanisch	nur in/only in 101 117 01,03...05
430 518 11	russisch	nur in/only in 101 117 01,03...05,10
430 519 28	englisch	nur in/only in 101 117 21...24
430 519 29	französisch	nur in/only in 101 117 21...24
430 519 30	italienisch	nur in/only in 101 117 21..24,29..32
430 519 31	spanisch	nur in/only in 101 117 21...24
430 519 32	russisch	nur in/only in 101 117 21...24

Hierzu: Drahtsatz
also see: wire set
383 272 94 in 101 117 01...32
383 273 22 in 101 117 03,05,06,08,11,13, 22,24,26,28,30,32
383 273 39 in 101 117 01...32
383 273 60 in 101 117 04,05,07,08,12,13 23,24,27,28,31,32

101 117 01...32 Bl.2 (Oberschale)
101 117 01 V (Verpackung)

Werkstoff						
Rohteil						
	j	4x	2027697	Sach-Nr und Text geändert, Text Nitrox	22.01.97	Deibel
	i	2 x	2028063	423 203 63 u. 927 230 39 in alle Varianten	05.05.97	G.Kalteis
	h	15 x	2027791	neues Original	03.04.97	G.Kalteis
Anz.-Index	Ausf.-Index	Änd.Nr.	Änderungstext		Datum	Name

Maßstab: 1:1
Datum / Name / Sach-Nr
Erstellt 03.04.97 G.Kalteis
Geprüft 03.04.97 A.Mändler
Norm
Freigabe
Format: A0
Benennung: Defibrillator CardioServ

Marquette Hellige GmbH
Munzinger Str. 3
D-79111 Freiburg

101 117 01...32 Bl.1

Fallhöh / Abmaße
Oberfläche
Freiheitsgrade
AEAD-Nr. 03112Z1j

Schutzvermerk nach DIN 34 beachten

927 230 40
M3x16 DIN 7985 (801 776 64)

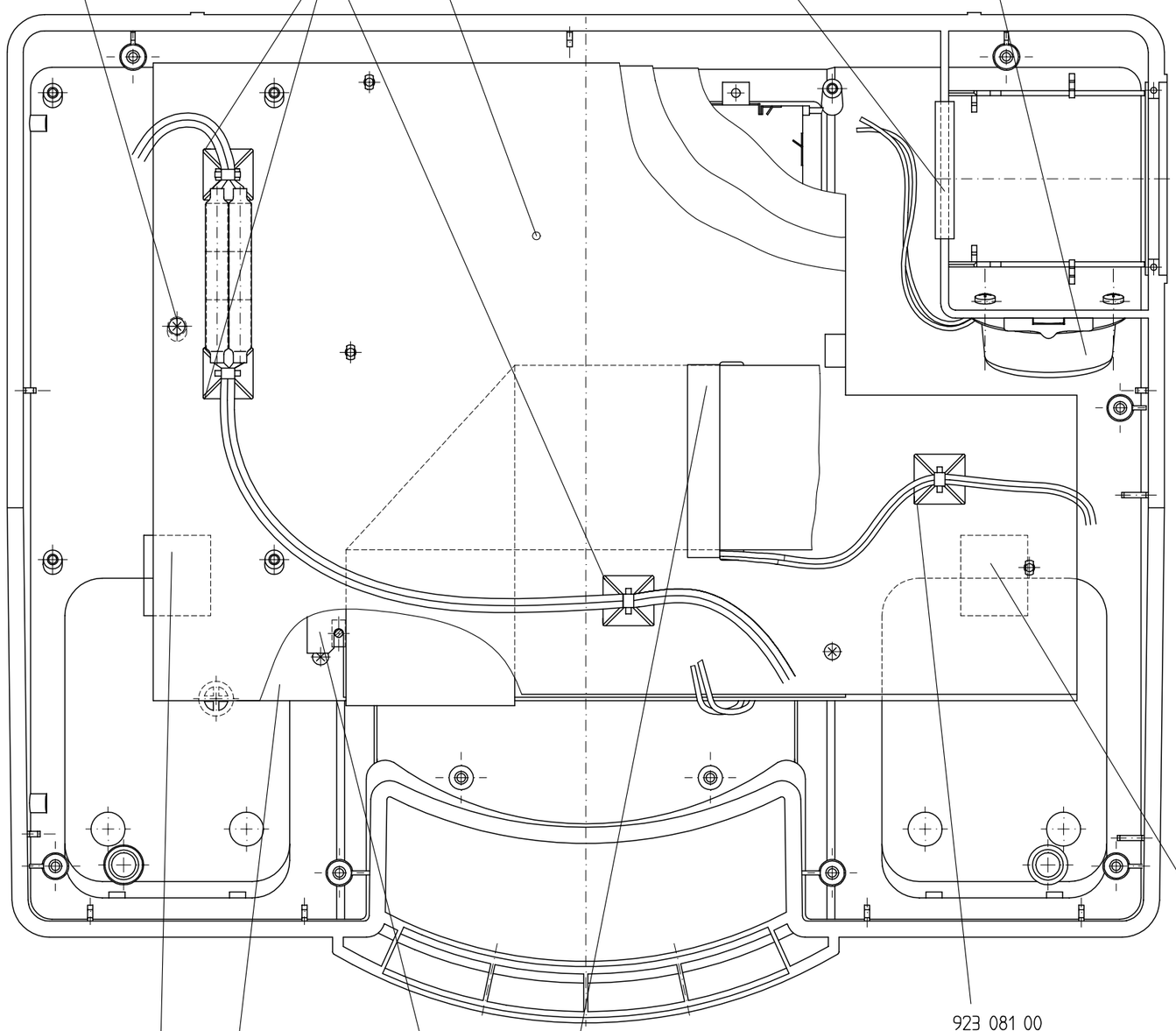
433 672 24
927 229 71
M3x16 DIN 7985 (801 776 64)

829 074 09
50mm lang

303 445 32
432 524 29
Plastite 45 3x10 (801 777 09)

Ansicht von Y in Oberschale
view of upper shell from Y

(f) 1) 3x 923 081 00
3x 923 096 69



829 074 36
50mm lang

(f) 2) 388 032 06
388 032 53
M3x6 DIN 7985 (801 776 31)

423 203 42

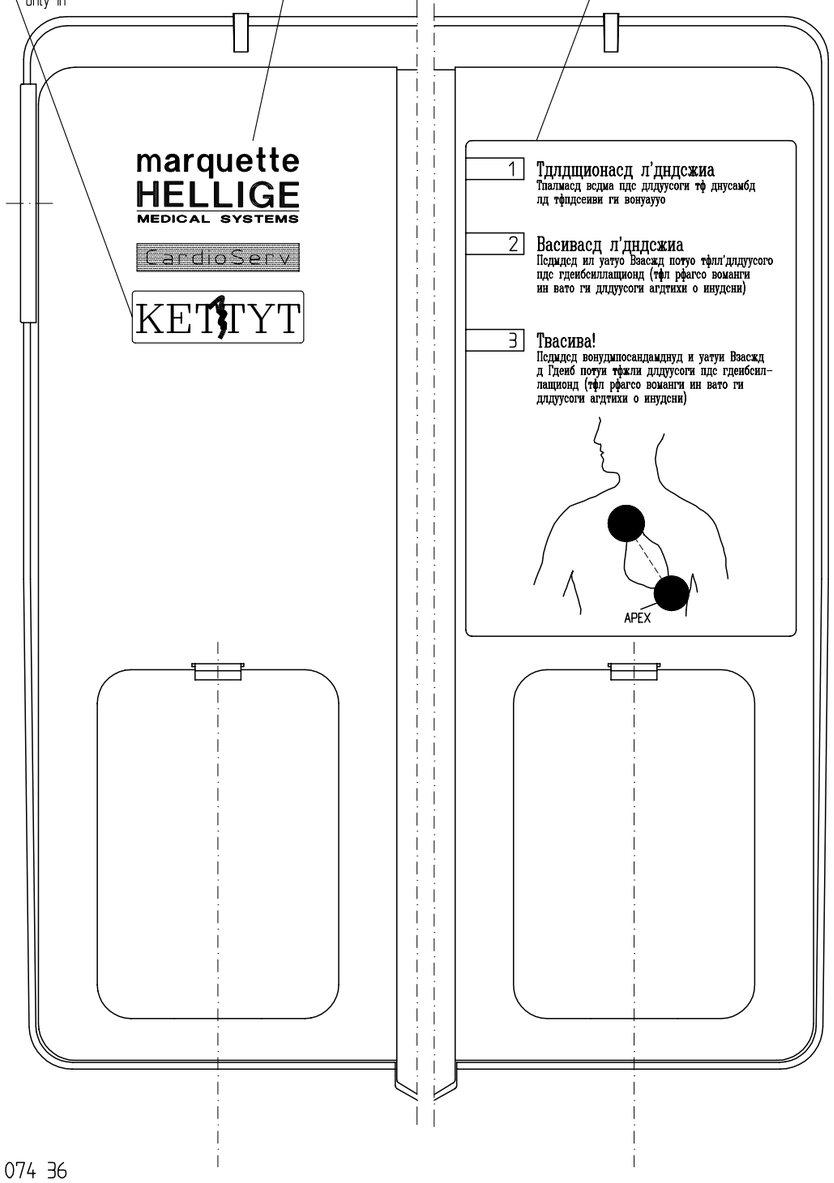
829 074 36
73mm lang

923 081 00
923 096 69

829 074 36
50mm lang

(f) 430 518 89
geklebt
nur in 101 117 10
only in

Bedruckung je nach
Oberschale



(f) 3) 430 518 09
430 518 11
430 519 30
siehe Beschilderungsblatt
see labels catalog

(f) 1)	383 273 22	nur in 101 117 03,05,06,08,11,13,22,24,26,28,30,32 only in
2)	388 032 06	nur in 101 117 03,05,06,08,11,13,22,24,26,28,30,32 only in
	388 032 53	nur in 101 117 01,02,04,07,09,10,12,21,23,25,27,29,31 only in
3)	430 518 09	nur in 101 117 02,06,07,08 only in
	430 518 11	nur in 101 117 10 only in
	430 519 30	nur in 101 117 29...32 only in

1) Hierzu Drahtsatz : 383 273 22
Wire set :

Werkstoff						
Rohteil						
	f	5 x	202791	neues Original	02.04.97	G.Kaltenb
	Änd.-Index	kommt vor	Änd.Nr.	Änderungstext	Datum	Name
Marquette Hellige GmbH Munzinger Str. 3 D-79111 Freiburg	Maßstab 1:1		Datum	Name	Sach-Nr. 101 117 01...32 Bl.2	
		Entworfen	02.04.97	G.Kaltenbach		
		Geprüft	02.04.97	A.Wendler		
		Normgepr.				
Paßmaß Abmaße Oberfläche	Freimaßtoleranz	Format	Benennung			
	ACAD-Nr. 03112Z2f	A1	Defibrillator CardioServ			

Schutzvermerk nach DIN 34 beachten

(H) Folientastatur
Membrane Keypad
390 001 52
390 001 62
390 001 68
390 001 69

(K)
1 rt +
sw 2 −

(O)
CA/1 gegn 3
1 sw M/2
2 gn CA/5

1 PACE+/
2 PACE

PACE/

KEYB/ 1 50

303 445 17
Optionen

DEBUG/ 10 1
OBACKL/ 1

BAT/ 1 2
CHU/ 1 4
PS/ 1 4
12VOUT/ 1 2
PS/
388 032 06
CB

ANALOG/ 50 1

RS232/ 10 1

AH/ 14 1
DIGITAL/ 50 1

(S) Display 930 117 17

(SA)
HOSIDEN/
388 032 06

(SB)
HBACKL/
388 032 06

HOSIDEN/ 1
(SA)
930 117 17

303 445 32

BEEP
sw
rt

BEEP/ 1
PRINT/ 34 1

HBACKL/ 1
(SB)
930 117 17

PS/
12VOUT/
388 032 05

(A)
Lpl CServ4_Digital
PCB CServ4_Digital
388 032 06 oder/or 388 032 53
u. Abschirmplatte 433 672 24
Shielding Plate 433 672 24

Thermokamm 303 439 76
(F)

(C) Lpl Motor
PCB Motor
388 010 56
(I)

Thermokamm 303 439 76
(F)
PRINT/
388 032 06

(C)
Lpl Netzteil
PCB Power Supply
930 117 97

(RA)
EKG/
388 032 05

(R)
303 442 99
Einbaudose
Panel Socket

(M)
CA/3 1
2 O/1

(CA) gn sw gegn
0/2 M/1 0/3

(CB) sw sw rt rt
388 032 05
PS/

(RA)
10 1
EKG/

(DA)
930 117 26

(B) Lpl CServ4_Analog
PCB CServ4_Analog
388 032 05

PAD/ 1 8
PACE 2
PACE+/ 1
PACE/
388 032 06

3 HV
4 HV+/
P/3
P/4

(P) rt bn ge rt rt
gn ws gn

(PA) 1 2 3 4 5 6 7 8

(AH)
388 032 05
(DA)

(DB)
303 443 57
SpO2

(D) Lpl MP204-Oxymeter Board
930 117 26 in 04,05,07,08,23,24,27,28,31,32

Hierzu Drahtsatz 383 272 94
Wire Set 383 273 22
383 273 39
383 273 60

Werkstoff					
~~Rohteil~~	Entw. W.Mikloss				
		a	-	202767	neues Netzteil 930 117 97
		And.-Index	kommt vor	And.Nr.	Änderungstext
Maßstab					
Marquette Hellige GmbH Munzinger Str. 3 D-79111 Freiburg					
Paßmaß / Abmaße					
Oberfläche					
Freimaßtoleranz					
ACAD-Nr. 02893S1a					

		24.07.97	G.Kaltenb
		Datum	Name
Datum	Name	Sach-Nr.	
Entworfen 20.11.96	G.Kaltenbach	101 117 21..32 S Bl.1	
Geprüft 20.11.96	W.Mikloss		
Normgepr.			
Format	Benennung		
A1	Defibrillator Cardioserv VF		

Diese Tabelle definiert die gültigen Konfigurationen des Cardioserv Version 4.1
This table defines the valid configurations of the Cardioserv Version 4.1

Komponente Component			Sach-Nr. Part No.	Index (Prod.)	kompatibel(Service) Compatible(Service)	in Variante in Device Variation	SW-Release
Digital	Lpl. Digital Ersatzteil-Nr. Austausch Nr.	PCB Digital Spare Part No. Replacement No.	388 032 06 - -	H1	B6,G1	22,24,26,28,30,32	V4.11
Digital	Lpl. Digital Ersatzteil-Nr. Austausch Nr.	PCB Digital Spare Part No. Replacement No.	388 032 53 - -	G	B4,F	21,23,25,27,29,31	V4.11
Analog	Lpl. Analog Ersatzteil-Nr. Austausch Nr.	PCB Analog Spare Part No. Replacement No.	388 032 05 - -	E	D1,D2	21...32	
	Lpl - MP 204 Ersatzteil-Nr. Austausch Nr.	PCB - MP 204 Spare Part No. Replacement No.	930 117 26 - -	C	B	23,24,27,28,31,32	

Index C entspricht : Revision A/1 oder A/2 oder A/3 oder A/4 oder A/5
(siehe Label CPU)

Änd.-Index	kommt vor	Änd.Nr.	Änderungstext	Datum	Name
i	-	203084	neuer Index Lpl Digital	16.09.97	G.Kaltenb
h	-	203030	Revision von Lpl-MP204 ergänzt	28.07.97	G.Kaltenb
g		202969/864	neuer Index Lpl Analog/Lpl Digital	01.07.97	G.Kaltenb
f	-	202959	neuer Index Lpl Analog	18.06.97	G.Kaltenb
e	-	202955	neuer Index Lpl Digital	13.06.97	G.Kaltenb
d	-	202939	neuer Index Lpl Analog	10.06.97	G.Kaltenb

Werkstoff

~~Rohteil~~ Entw. W.Mikloss

Marquette Hellige GmbH
Munzinger Str. 3
D-79111 Freiburg

Maßstab: -

	Datum	Name
Entworfen	13.12.96	G.Kaltenbach
Geprüft	13.12.96	W.Mikloss
Normgepr.		

Sach-Nr. 101 117 21..32 S Bl.2

Paßmaß | Abmaße

Oberfläche

Freimaßtoleranz

ACAD-Nr. 02893S2i

Format A4

Benennung: Master Record Index Cardioserv Version 4.1

Schutzvermerk nach DIN 34 beachten

Schutzvermerk nach DIN 34 beachten

803 014 00
804 041 00
504 658 20
402 236 14
416 118 28
927 229 55 ⓒ ⓚ

803 014 00
804 041 00
504 658 23
427 338 70
927 230 11
804 077 00
ⓔ ⓑ 430 518 28
902 153 00
902 261 00
902 096 00
927 229 46 ⓓ
923 081 00
803 014 00
804 041 00
927 230 20 ⓗ
10
805 124 17
430 517 85 ⓐ ⓒ

803 014 00
804 041 00
402 216 00
427 338 69

Anschlu?plan
Connection Diagram
Plan des bornes
Schema dei collegamenti

Hier +12V anschließen
Connect +12V here
Ici raccordement de +12V
Collegare +12V qui

Hier Masse KNX anschließen
Connect chassis KNX here
Ici raccordement de la masse KNX
Collegare la massa KNX qui

sw rt/sw rt

rt sw rt/sw

504 658 22
504 658 21
923 096 69
915 417 16
915 413 29
801 776 31
914 326 43

Achtung!
Befindet sich der CardioServ in der Autohalterung, bezieht sich die Meldung "Batterie laden" auch auf den Ladezustand der Fahrzeugbatterie.

Caution!
When CardioServ is installed in the defibrillator mounting system, the "Low Battery" message also refers to the charge level of the car battery.

Attention!
Si le CardioServ est placé dans le support de montage du défibrillateur, le message «Charger la batterie» se réfère aussi ? l'état de charge de la batterie du véhicule.

ⓖ ⓔ 908 122 63
908 122 31
ⓗ 912 084 59
504 658 18
ⓗ ⓖ 915 420 28
915 394 00
916 124 00
915 418 14
915 287 00
915 394 00
915 287 00
915 394 00
Kontakt 1 und 2 an den Schaltern abgezwickt
388 011 38

Beachte hierzu auch Schaltplanzeichnung 202 307 01 S !

lose beigelegt wird:
Puffer d=12x1,5 dick 924 017 14 - 6 Stück ⓕ
Zylinderschraube M4x12 DIN912 B9 4 Stück
Fuß ---------- 504 658 19 - 2 Stück
ⓒ unterer Fuß ------ 504 658 56 - 2 Stück
6 Kt Stiftschlüssel -- 832 001 00 - 1 Stück

ⓗ ⓖ Steckerhülse 4,8x0,5 915 420 28 - 2 Stück
ⓖ Isolierhülse --------- 915 394 00 - 2 Stück
Kabelband ---------- 923 081 00 - 1 Stück
Befestigungssockel -- 923 017 13 - 1 Stück
ⓑ Montageanleitung --- 440 081 80 - 1 Stück
ⓔ Plastiteschraube 4x16 801 777 48 - 4 Stück
ⓔ Schraubkappe --- 908 122 32 - 1 Stück

alle Teile in Polybeutel
931 098 41 verpackt

h	Lx	202811	Etikett hinzu,Sicherung u. Steckerhülse geänd.	30.04.97	G.Kaltenb.
g	Hz	202674	Sicherungshalter geaendert	27.01.97	A.Wendler
f	Ns	202629	Sach-Nr. 924 017 13 geändert in 924 017 14	02.12.96	T.Kaltenbach
e	Sx	202596	Sicherungshalter und Klebeetikett geaendert	25.11.96	A.Wendler
d	Ns	202381	Klebeschild hinzu	15.07.96	A.Wendler
c	Jh	202026	unterer Fuss hinzu, Position Typschild geaendert	31.10.95	A.Wendler
Aen.-Index	Loesch-vermerk	Aend-Nr.	Aenderungstext	Datum	Name

Werkstoff
Rahmen

Marquette Hellige GmbH
Münzinger Str. 3
D-79111 Freiburg

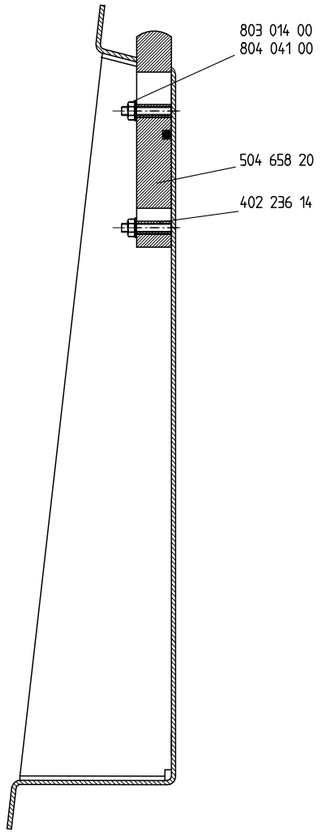
	Datum	Name
Entwurf	12.04.95	A.Wendler
Gepr?ft	18.04.95	A.Wendler
Norm		

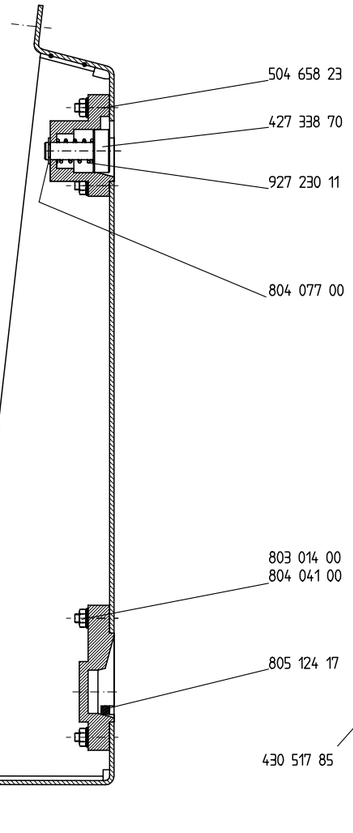
Sach-Nr. 202 307 01

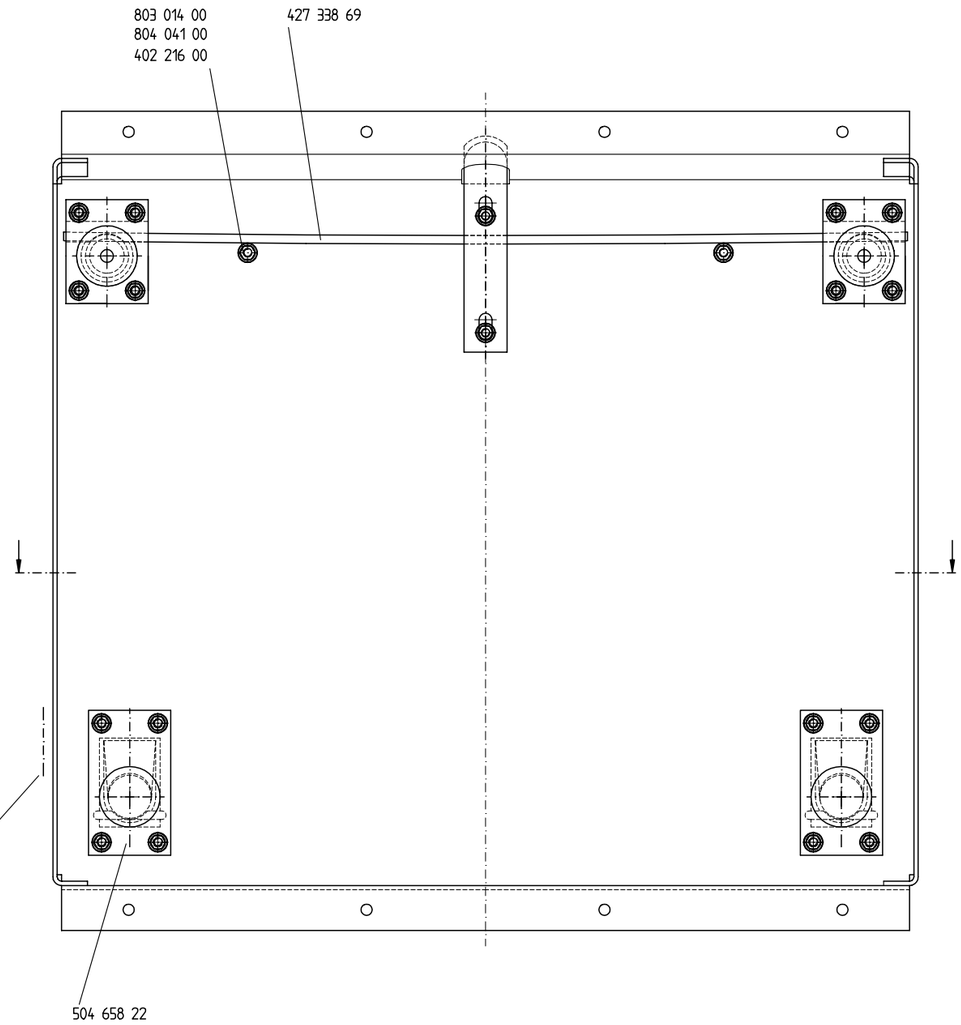
Halbzeit: 1:1
Format: A0
Benennung: Autohalterung fuer CardioServ

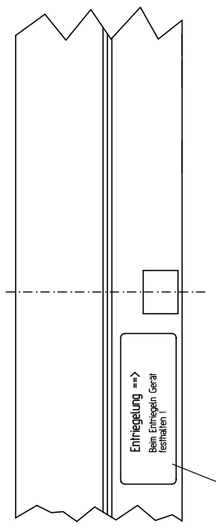
Fallmaß Abmaße
Oberfläche
Freimaßtoleranz: DIN 7168 mittel
AEAD-Nr. 021192?h

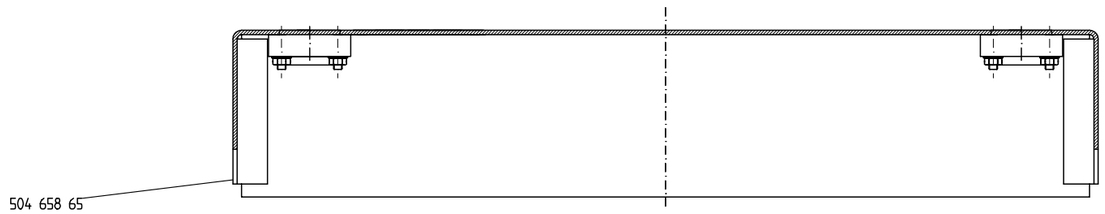
Schutzvermerk nach DIN 34 beachten











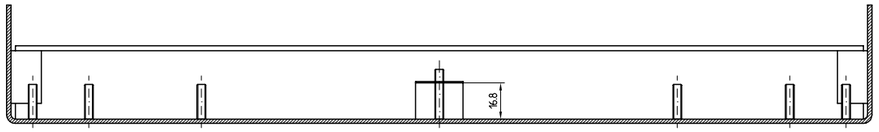
lose beigelegt wird:
Puffer d=12x1,5 dick 924 017 14 - 6 Stück (4)
Zylinderschraube M4x12 DIN912 B9 4 Stück
Fuß ---------- 504 658 19 - 2 Stück
unterer Fuß ------ 504 658 56 - 2 Stück
6 Kt Stiftschlüssel -- 832 001 00 - 1 Stück
Montageanleitung --- 440 082 27 - 1 Stück

alle Teile in Polybeutel
931 098 41 verpackt

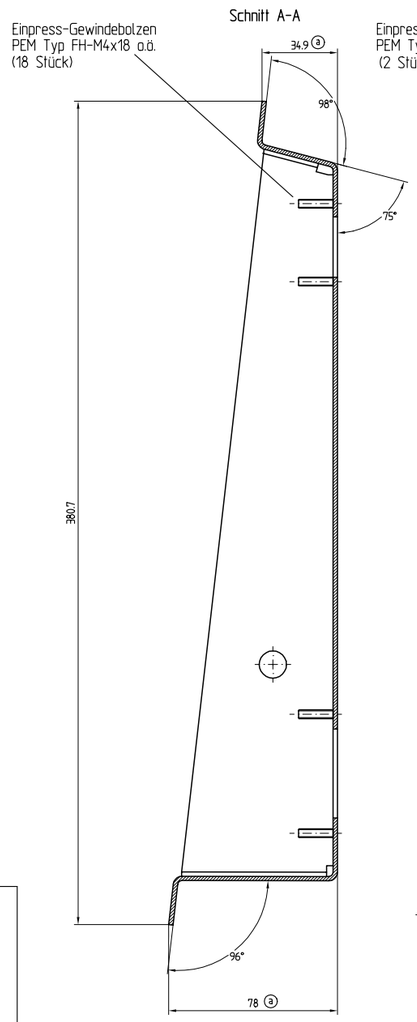
Werkstoff							
Rohteil							
	a	1x	282620	Sach.-Nr.924 017 13 in 924 017 14 geändert	02.12.96	T.Kallenbach	
	Änd.-Index	Ersatz-teil von	Änd.Nr.	Änderungstext	Datum	Name	
Marquette Hellige GmbH Munzinger Str. 3 D-79111 Freiburg	Maßstab 1:1		Datum	Name	Sach.-Nr. 202 307 02		
		Erstellt	06.12.95	A.Wender			
		Geprüft	06.12.95	A.Wender			
		Norm-prüf.					
Fertigmaß Abmaße	Format A0				Benennung Wandhalterung für CardioServ		
Oberfläche	Freigabevermerk DIN 7168 mittel						
	ACAD-Nr. 023697ta						

Schutzvermerk nach DIN 34 beachten

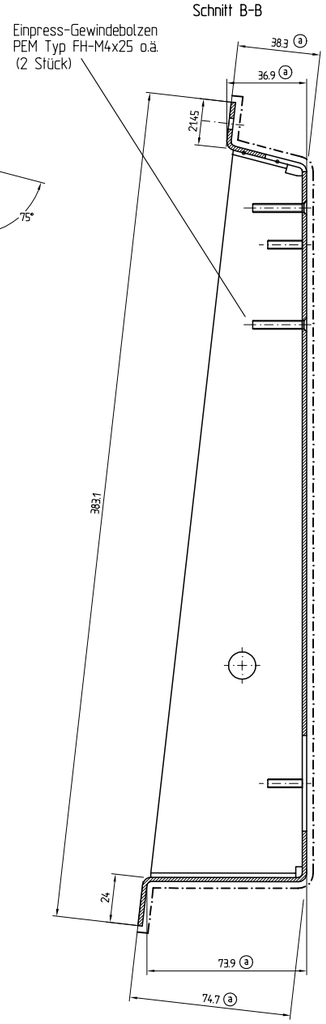
Schnitt D-D

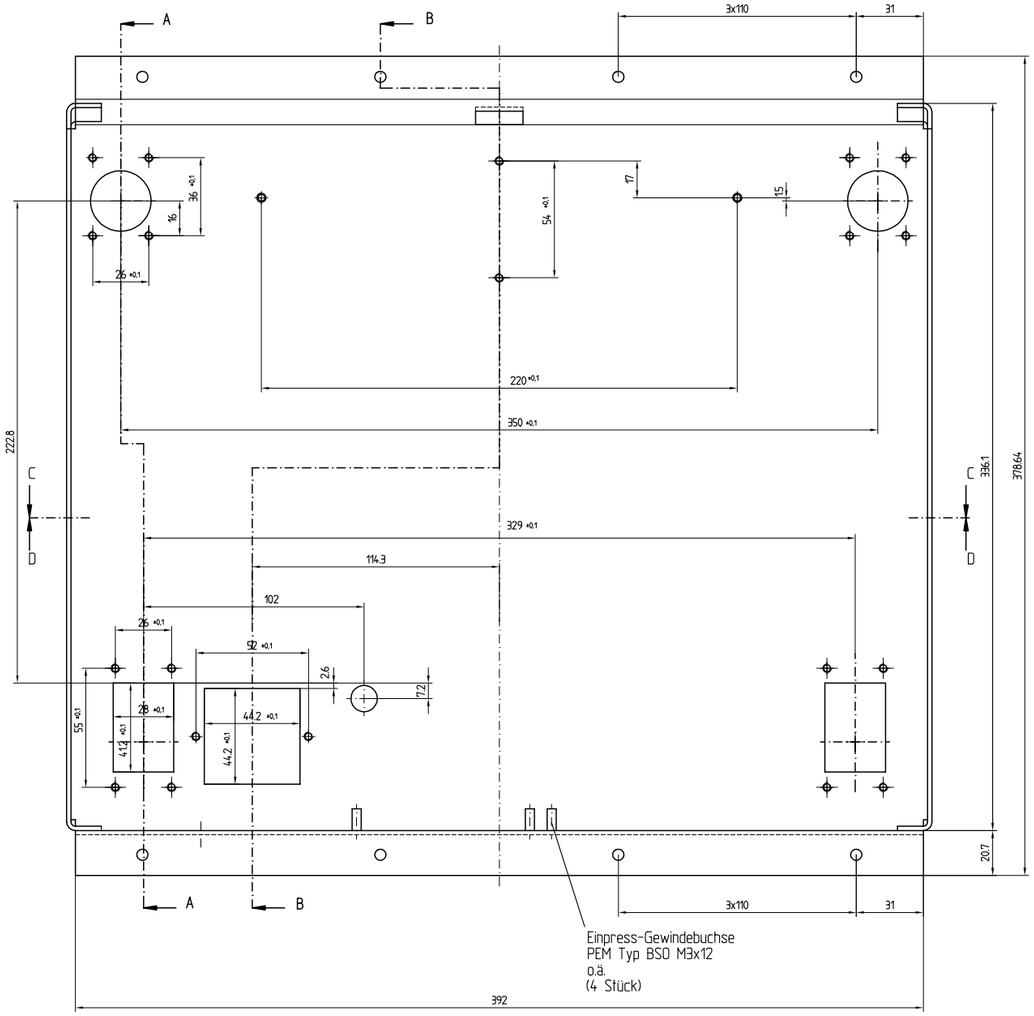


Schnitt A-A

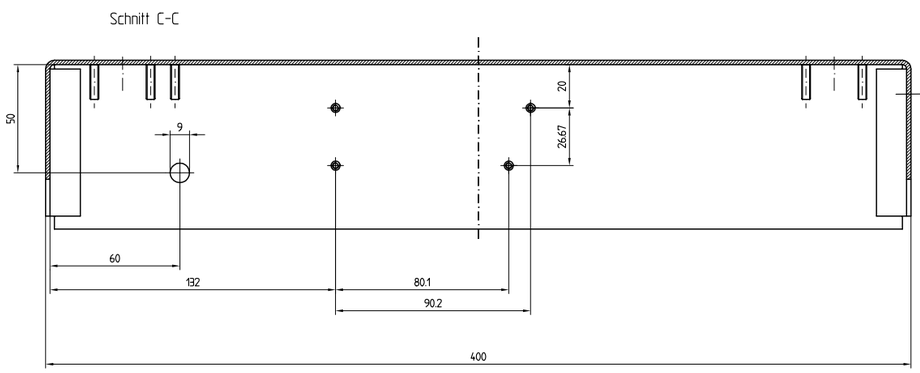


Schnitt B-B



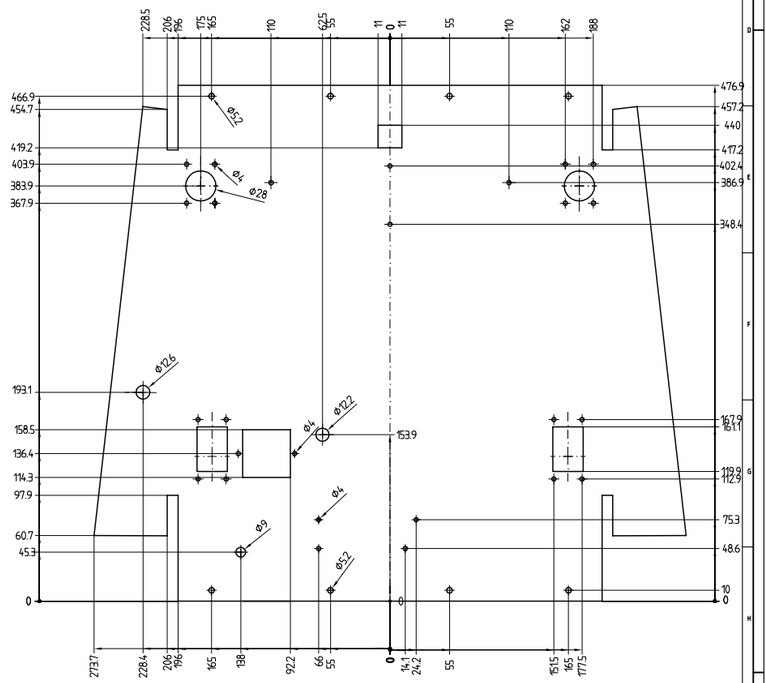


Schnitt C-C



Alle Laschen punktgeschweißt
oder mit Hohlnieten genietet

Abwicklung M 1:2



a Platinenmaße sind gerechnete Maße !
Genaue Maße müssen durch Biegeversuche ermittelt werden !!

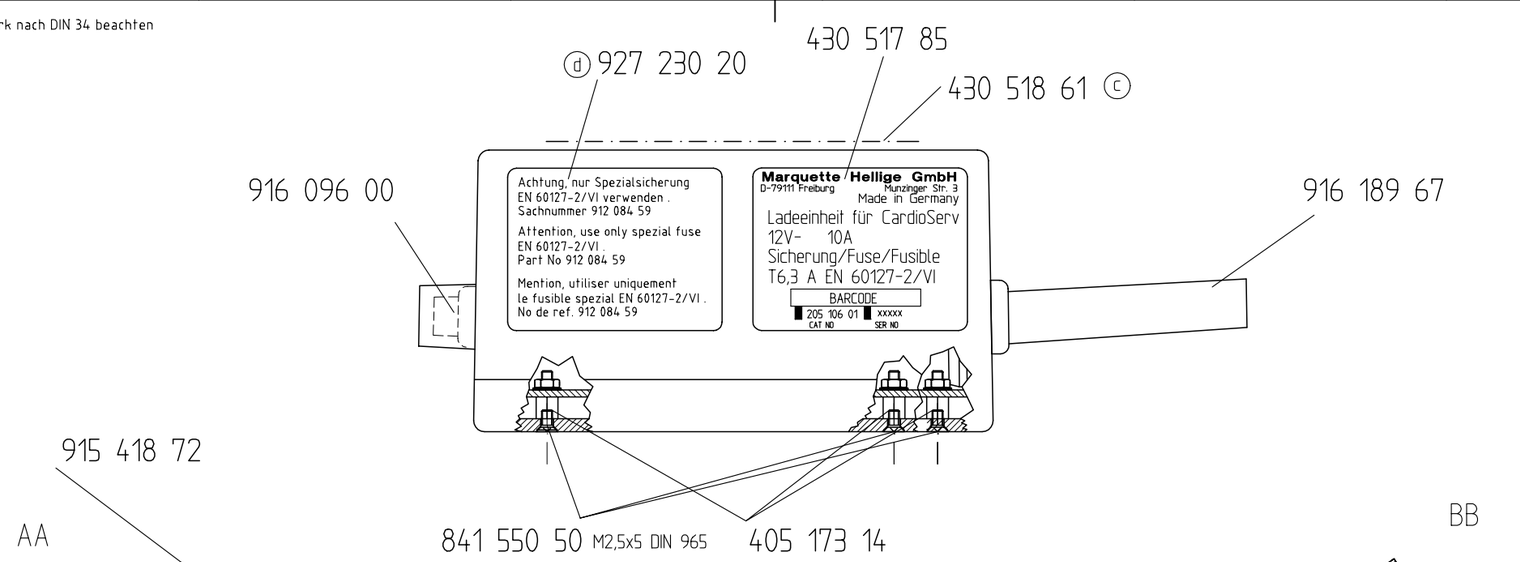
Gewinde-Einpressbolzen
nach dem Beschichten auf
Oberfläche nicht sichtbar

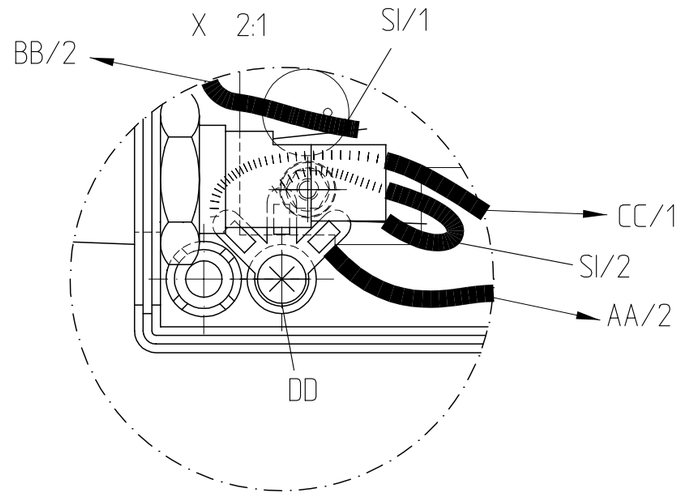
Alle Biegekanten R2

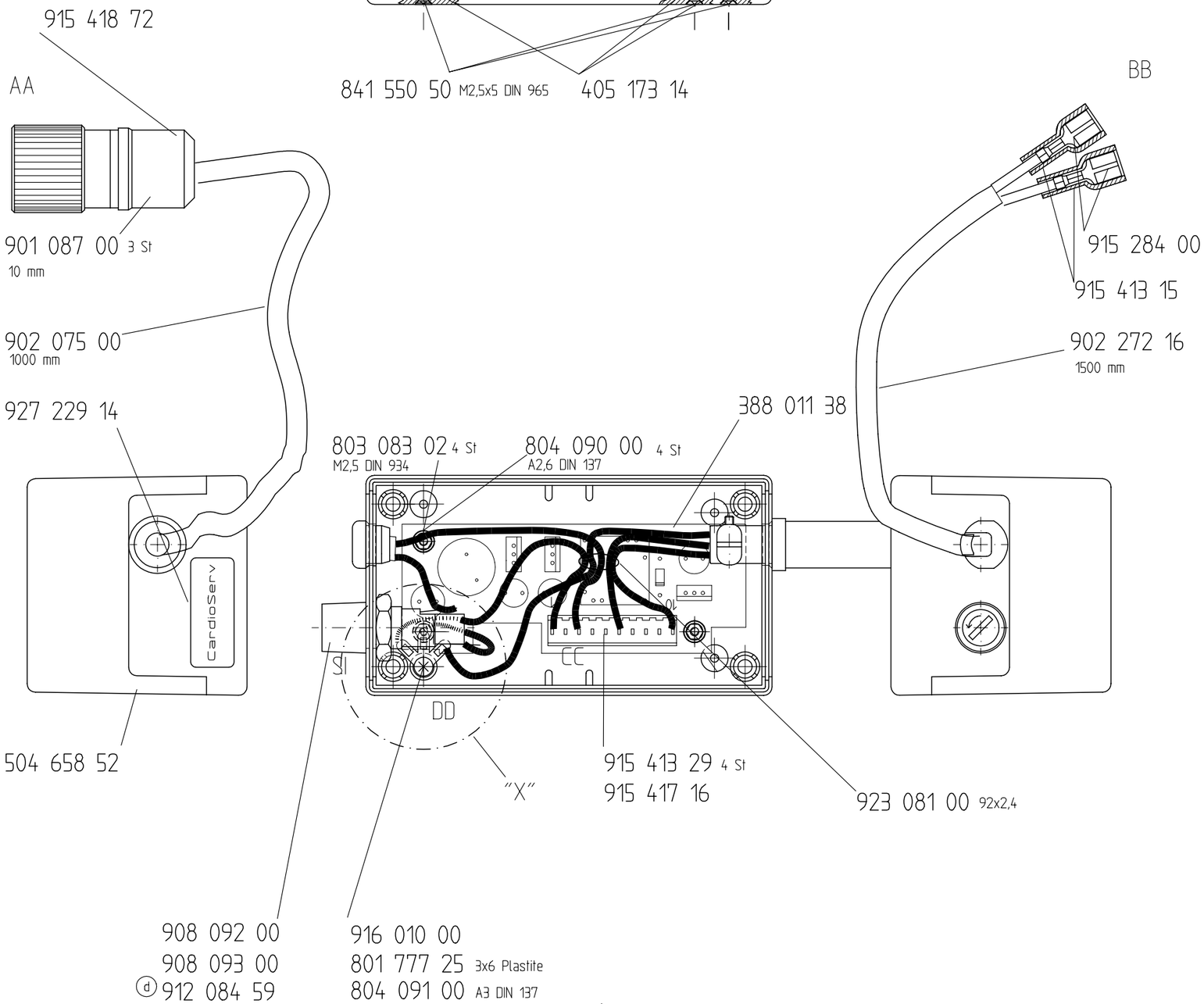
pulverbeschichtet RAL 9002, glatt

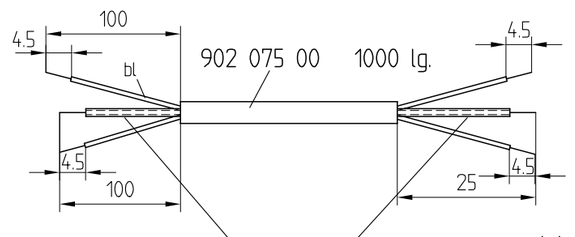
Werkstoff: AlMg3 H111-W19					
Norm: BL 2 DIN 1783	a	7x	202118	Kontur um 1mm Richtung Wand vergrößert	11.12.95 A.Mender
	Änd.-Index	Anzahl	Änderungsdat.		Datum Name
HELLIGE GMBH Postfach 728 D-79007 Freiburg	Maßstab 1:1	Datum Name	Sach-Nr. 504 658 18		
		Bearb. 13.04.95 A.Mender			
		Gepr. 13.04.95 A.Mender			
		Norm			
Fallmaß Abnahe Oberfläche	Freimaßtoleranz DIN 7168 mittel	Format A0	Benennung Gehäuse, Autohalterung		
	Archiv-Nr. 0211821a				

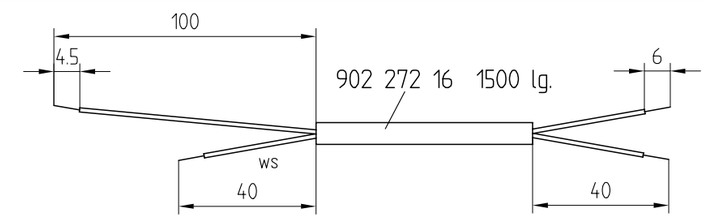
Schutzvermerk nach DIN 34 beachten











Lfd. Nr.	Pos.	Symbol	Abisolierlänge mm	Pos.	Sach-Nr. 902...	Farbe	Länge mm	mm² AWG	Bemerkungen und Skizzen
1	AA/1		4,5 / 4,5	CC/10	075 00	br	1000	18	915 413 29
2	AA/2		4,5 / 4,5	DD	075 00	bl	1000	18	
3	AA/		4,5 / 4,5	CC/6	075 00	gn/ge	1000	18	
4	BB/1		6.0 / 4,5	CC/3	272 16	sw	1500	18	915 284 00
5	BB/2		6.0 / 4,5	SI/1	272 16	ws	1500	18	und 915 413 15
6	SI/2		4.5 / 4,5	DD	153 00	rt	30	18	
7	DD		4.5 / 4,5	CC/1	153 00	rt	100	18	
8	AA				901 087 00		3x10		
9	AA				901 127 00	sw	20,5		
10	CC/6				901 127 00	sw	95.5		

Änd.-Index	kommt vor	Änd.Nr.	Änderungstext	Datum	Name
d	2 x	202835	Sicherung in 912 084 59,Etikett hinzu	29.04.97	G.Kaltenb
c	1x	202299	Firmenschild geändert	02.05.96	Koch
b	--	202097	Symbol für Kontakt geändert	04.12.95	A.Wendler
a	--	202036	Leitungen und Zeichnungsaufbau geändert	11.10.95	A.Wendler

Werkstoff

Rohteil

Marquette Hellige GmbH
Munzinger Str. 3
D-79111 Freiburg

Maßstab 1:1

	Datum	Name
Entworfen	11.08.95	A.Wendler
Geprüft	11.08.95	U.Steffan
Normgepr.		

Sach-Nr. 205 106 01

Paßmaß | Abmaße

Oberfläche

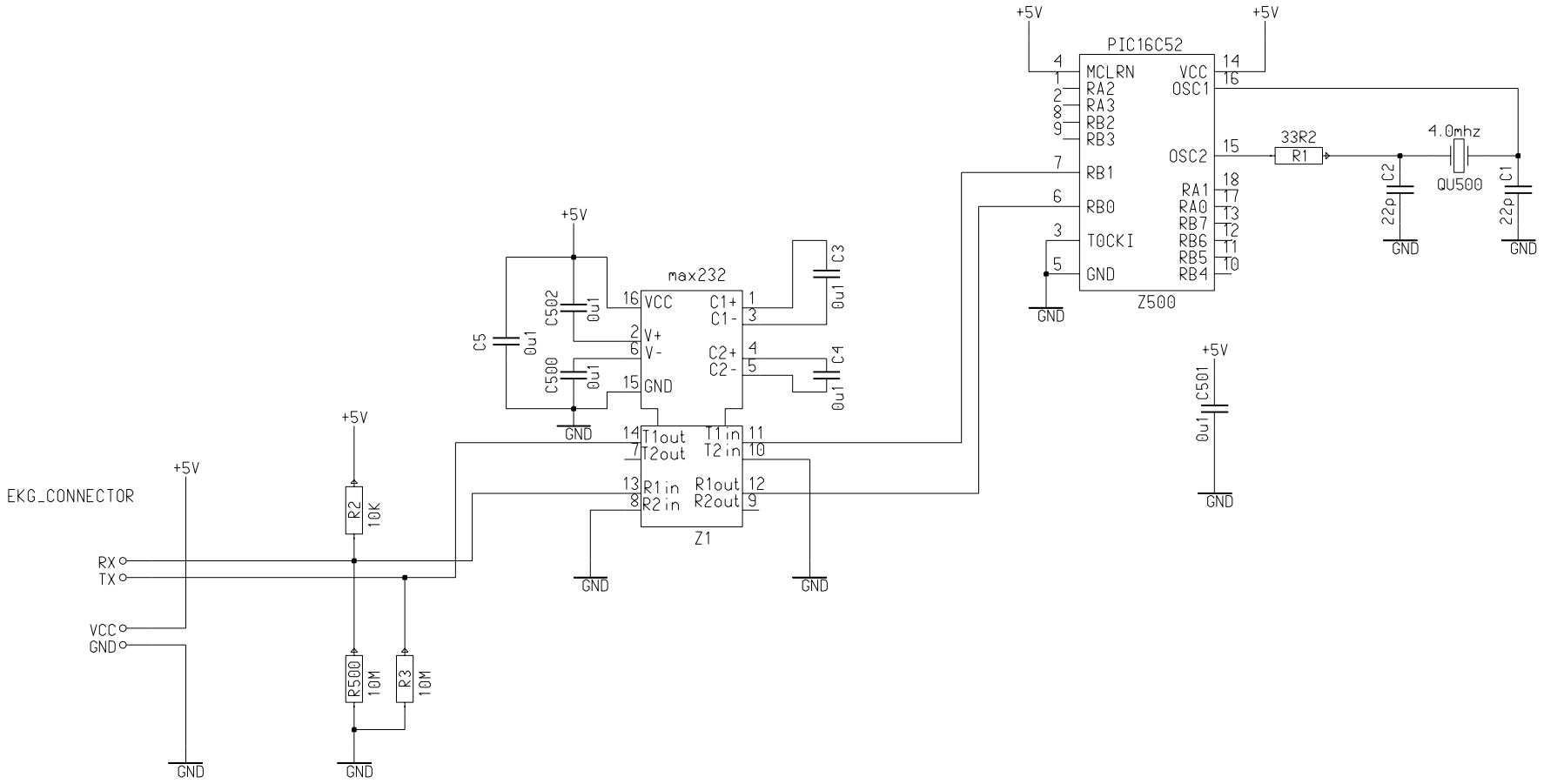
Freimaßtoleranz ISO 2768 - m

ACAD-Nr. 02147Z1d

Format A2

Benennung: Ladeeinheit für CardioServ

Schutzvermerk nach DIN 34 beachten



Marquette Hellige GmbH D-79007 Freiburg						388 032 03 P
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name		A04	F67211
1)						Date / Name
2)					DRAWN	21.03.96/SNA
3)					APPROVED	11.07.96/SNA
4)						
5)					ISSUED	M&E/ALLGEIER

Sheet: 1 of 1

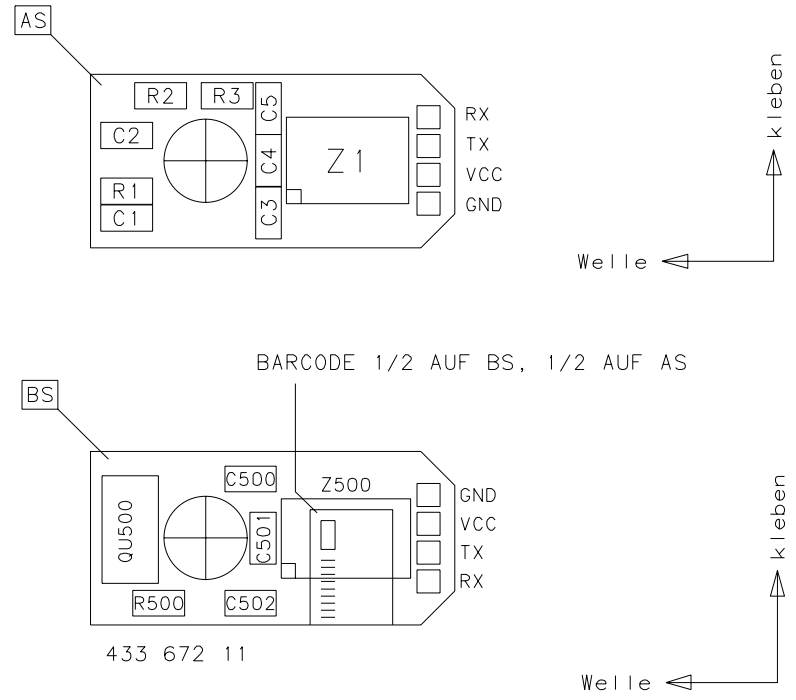
LPL DEFI_HWDONGLE

PCB DEFI_HWDONGLE

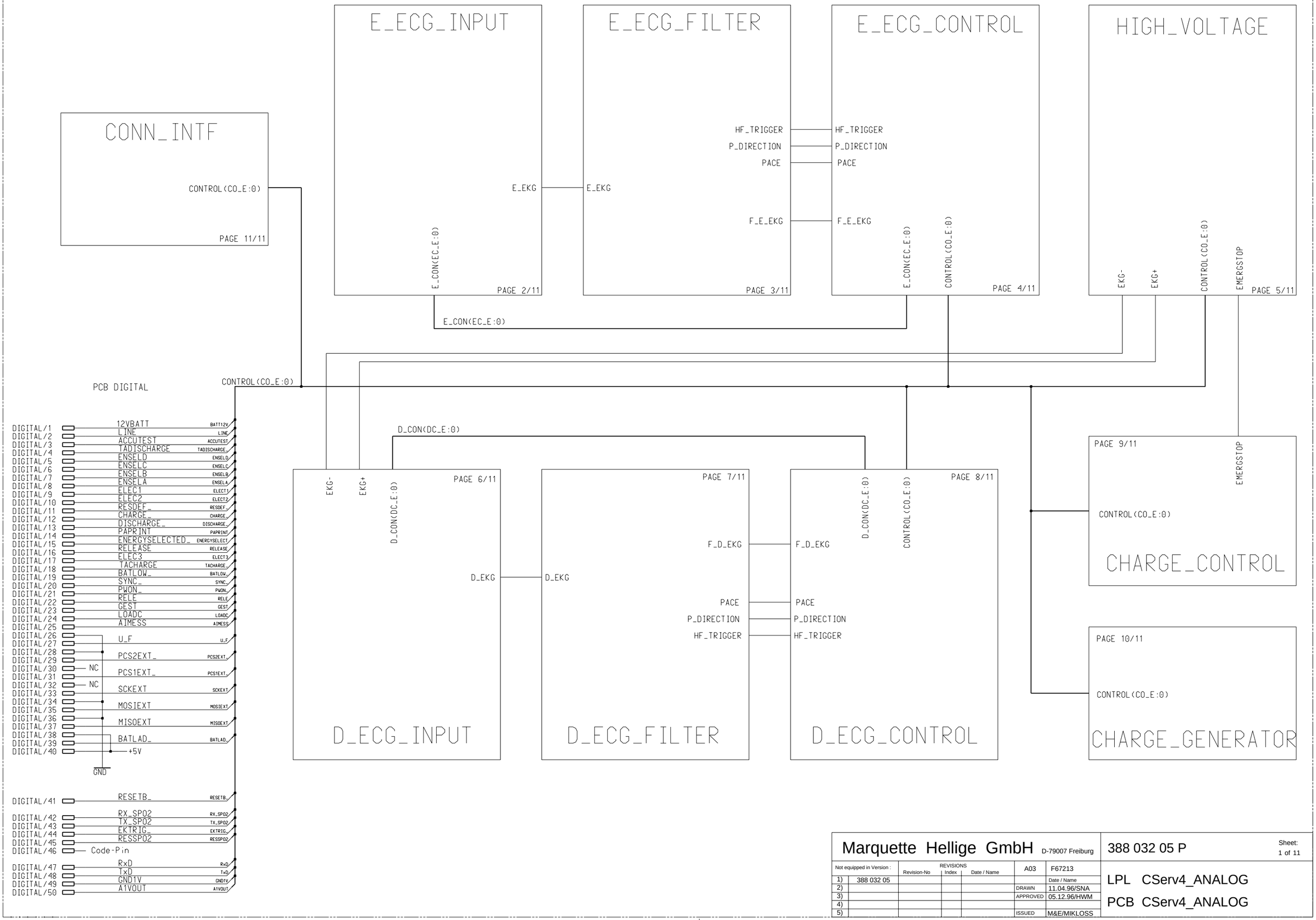
[1997, 7, 1, 3]

Schutzvermerk nach DIN 34 beachten.

BT-AS = 9
BT-BS = 10
LOET-AS = 36
LOET-BS = 28



Marquette Hellige GmbH D-79007 Freiburg				388 032 03 R
REVISIONS			M1.5:1	A04 F67211
Revision-No	Index	Date/Name		Date/Name
			Drawn	17.04.96/JOK
			Approved	17.04.96/JOK
			Issued	M&E/ALLGEIER
				LPL.DEFI_HWDONGLE
				PCB DEFI_WWDONGLE



Marquette Hellige GmbH D-79007 Freiburg						388 032 05 P
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67213
1)	388 032 05					Date / Name
2)					DRAWN	11.04.96/SNA
3)					APPROVED	05.12.96/HWM
4)						
5)					ISSUED	M&E/MIKLOSS

LPL CServ4_ANALOG

PCB CServ4_ANALOG

Sheet: 1 of 11

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design

E_ECG_INPUT

GUARD CIRCUIT

+VF, +2DF, R8 100k, D5 BAS32, D4 BAS32, D3 BAS32, D6 BAS32, R35 100k, 2DF, -VF, GNDF

RK 1 — EKG/ 1 — R513 100k — R512 47k5 — E_RKF
LK 5 — EKG/ 2 — R518 100k — R515 47k5 — E_LKF
FK 3 — EKG/ 3 — R510 100k — R508 47k5 — E_FKF
CK 2 — EKG/ 4 — R517 100k — R516 47k5 — E_CKF
NK 4 — EKG/ 5 — R511 100k — R509 47k5 — E_NKF

NEON_90V, UEA503, UEA502, UEA501, UEA504, UEA500, GNDSF
C519 100p, C521 100p, C518 100p, C527 100p, C515 100p, GNDF
D23, D21, D25, D27, D13, D22, D26, D32, D14, D12 FDLL300, +2DF, -2DF

ECG ELECTRODES

Cod1 6 — EKG/ 7 — R91 100k +5VF — R92 100k — E_LET1
Cod3 9 — EKG/ 10 — R90 100k +5VF — R89 100k — E_LET2
Cod2 7 — EKG/ 8
EKG/ 9 — COD.
10 — EKG/ 6 — SCHIRM — R63 150r
C46 47n, C47 47n
GNDSF, GNDF

3pol :Bruecke Cod1 - Cod2
5pol :Bruecke Cod1 - Cod2 - Cod3

Schutzvermerk nach DIN 34 beachten

LEAD PRESELECTOR

CD4053: E_WB5, E_WB6, E_WB7, -VF → E_VR
CD4053: E_WB8, E_WB9, E_WB10, -VF → E_VL
CD4051B: -VF, E_WB5, E_WB6, E_WB8 → E_VF
Z510, Z513, Z506

ELECTRODE AMPLIFIER

E_VN
E_VR: R503 33M, C26 100p, R61 4k99, -2DF, GNDF
E_VL: R507 33M, C27 100p, R88 4k99, -2DF, GNDF
E_VF: R506 33M, C25 100p, R86 4k99, -2DF, GNDF
E_VC: R504 33M, C28 100p, R62 4k99, -2DF, GNDF

V507 TL074CD, -VF
C15 220p, R34 30k1, C29 47n, C24 47n → E_R
C45 220p, R87 30k1, C22 47n → E_L
C44 220p, R85 30k1, C23 47n → E_F
C16 220p, R36 30k1, C21 47n → E_C

E_ANA(EA_E:0)

LEAD SELECTOR

E_CON(EC_E:0)

R84 10k, C43 10n, R114 33k2, V512 TL064CD, R112 100k, R113 100k

CD4053: E_WB1, E_WB2, E_WB3, -VF → E_R, E_L, E_F
Z509

CD4051B: -VF, E_WB1, E_WB2, E_WB4 → E_R, E_L, E_C
Z512 CD4051B

ECG AMPLIFIER

R139 15k8, R138 15k8, R140 15k8
R144 15k8, R141 15k8
R116 22k6, R142 22k6
R143 47k5, C70 47k5, R115 47k5
C62 220p, C63 220p, C1 1n
C61 47n, C60 47n
V512 TL064CD, +VF, -VF, GNDF
E_EKG

LEAD FAULT DETECTION

E_R: R205 200k, R207 1M, C95 0u22 → V518 LM339 → R184 68k1, R183 100k → E_R_ELF
E_L: R206 1M, C94 0u22 → V518 LM339 → R186 68k1, R185 100k → E_L_ELF
E_F: R202 1M, C92 0u22 → V518 LM339 → R180 68k1, R181 100k → E_F_ELF
E_C: R203 1M, C93 0u22 → V518 LM339 → R179 68k1, R182 100k → E_C_ELF
+VF, +5VF, -VF, GNDF

Marquette Hellige GmbH D-79007 Freiburg						388 032 05 P	Sheet: 2 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67213	
1)	388 032 05					Date / Name	LPL CServ4_ANALOG
2)					DRAWN	11.04.96/SNA	
3)					APPROVED	05.12.96/HWM	PCB CServ4_ANALOG
4)							
5)					ISSUED	M&E/MIKLOSS	

[1996, 12, 6, 6]
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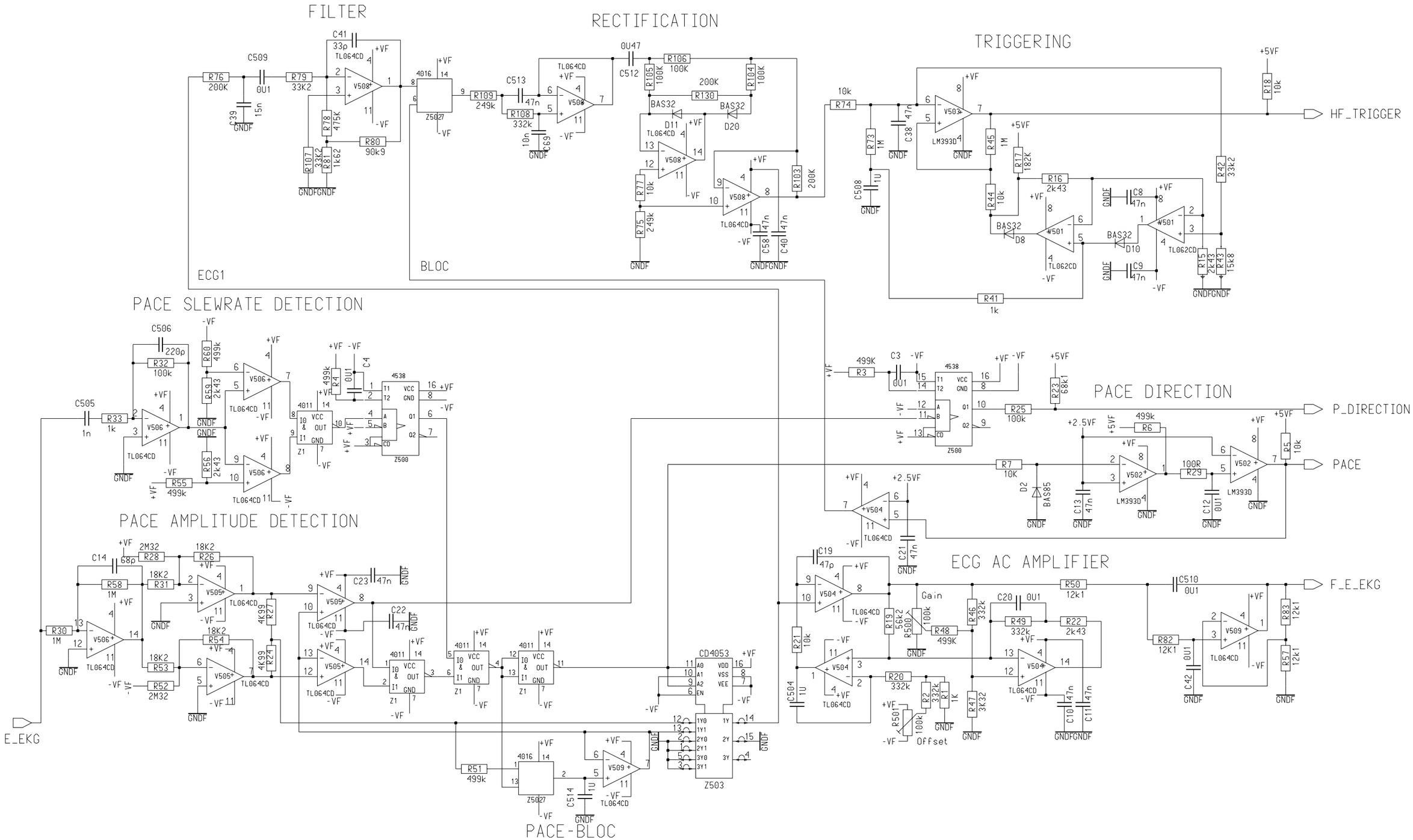

E_ECG_FILTER

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg					388 032 05 P	Sheet: 3 of 11
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67213	LPL CServ4_ANALOG
1) 388 032 05	202 826	A	14.04.97/JOK		Date / Name	
2)				DRAWN	11.04.96/SNA	PCB CServ4_ANALOG
3)				APPROVED	05.12.96/HWM	
4)						
5)				ISSUED	M&E/MIKLOSS	

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/e_ecg_filter

CONTROL REGISTER

E_CON(EC_E:0)

+VF R157 1k — 4094 (C2, EN3, SRG8, C1/, 3.0ZD000, 1D) — E_WB1 E_WB2 E_WB3 E_WB4 — Z2

+VF C85 47n, -VF R178 1k — 4094 — E_WB5 E_WB6 E_WB7 E_WB8 E_WB9 E_WB10 — Z3

R132 1k2, R131 1k2, R133 33k2 — V513 LM339 (+VF, -VF, +2.5VF)

R153 33k2 — V513 LM339 — 74HCT14 Z508 GNDFD — R152 2k21 — R128 2k21 — C71 2n2 — R129 4k75

E_LET1 E_LET2

STATUS REGISTER

74HCT166 (SRG8, M1[SHIFT] M2[LOAD], VCC, GND, C3/1->, 1,3D, 2,3D, 2,3D) — Z5

R201 10K, R200 10K, R199 10K, R198 10K, R197 10K

C91 47n — D19 BAS32 — C511 4u7 — R127 100k — 74HCT14 Z508

E_R_ELF_ E_L_ELF_ E_F_ELF_ E_C_ELF_

74HCT166 (SRG8, M1[SHIFT] M2[LOAD], VCC, GND, C3/1->, 1,3D, 2,3D, 2,3D) — Z516

R177 10K

HF_TRIGGER P_DIRECTION PACE

V516 LM393D — +2.5VF

R176 10k

STATE MACHINE

R172 10K, R171 10K

ECG_CONTROL (SCLK, PCSX_, MOSI, IN1, IN2, IN3, IN4, IN5, RESET_, GND, VCC, ADUCS_, LOAD_, STRB, Q4, Q3, Q2, Q1, Q0, OE_) — Z514 16V8

C89 47n — R194 475r

QSPI INTERFACE

CONTROL(CO_E:0)

R126 4k75, R101 4k75, R102 4k75

74HCT14 Z508 GNDFD — HCPL2630 X504 — R100 681r — 74HCT125 Z505 — SCKEXT

R72 681r — MOSIEXT

IS609 X505 — R124 681r — PCS1EXT

C57 47n — C55 68p — C56 68p — C68 68p — GND

74HCT14 Z508 — IS609 X506 — R125 681r — R123 10r — R151 4k75 — 74HCT125 Z505 — MISOEXT — RESETB_

C67 47n

SWITCHING REGULATOR

D34 BAS29 — R209 221r — C96 1n5 — R165 2k21 — C75 10n — R188 36k5

+VIN, ERR*, SHDN, FB, VOUT, SENSE, 5VTAP, GND — V515 lp2951amc

R208 10r — D35 BAS29 — R210 332r — C86 1n — C74 0u1

R166 100k — R189 100k — C76 3n3 — T4 BC857B — R211 2k21 — R167 100k — C97 1n

+7,5V +VF — R193 23r7 — C88 470p — D36 BAS29 — C520 47u — C525 47u — C81 47n

L/3 — o Anfang — 30343948 TR502 — L/4 — o Markierung — D517 SMBJ20C

C524 47u — C80 47n — D31 BAS29 — R192 23r7 — C87 470p — -VF -7,5V

BC847B T3 — SR_VSW

X507 LT1170 (VSW, VIN, FB, GND, VC) — C523 47u — C79 47n — D37 ZMM4V7 — C98 47n

R168 100k — C78 47n — R191 150k — R169 22k6 — T5 BC847B — T6 BC847B — SR_ON — R212 22k6

R170 1K — C77 47n — R190 1k — R213 10k

FLOATING 5V SUPPLY

33M R505 — GNDSF

V517 TL750L05 (OUT, IN, GND) — +5VF — +VF

R195 10K — R196 10K — C90 47n — C528 15u

NON FLOATING

L504 0u1 — L505 0u1 — GND

+12V — L506 0u1 — L507 0u1 — +12VSR

E_ECG_CONTROL

ADC

LTC1290 (CH0, CH1, CH2, CH3, CH4, CH5, CH6, CH7, COM, DGND, VCC, ACLK, SCLK, DIN, DOUT, CS_, REF+, REF-, V-, AGND) — Z511

R136 2k21, R135 2k21, R156 2k21, R154 2k21, R155 2k21

L3 1u — C526 15u — C84 47n

F_E_EKG — R110 47k5 — C59 47n — V511 LMC6484

R134 47k5, R111 47k5, R137 47k5

3,6MHZ-OSCILLATOR

R173 5k76, R175 1M, R174 243r — 3.6864MHZ QU501 — C72 47p, C73 47p, C82 47n — 74HCU04

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 05 P	Sheet: 4 of 11
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67213		
1) 388 032 05	202 957	A	15.07.97/JOK		Date / Name	LPL CServ4_ANALOG	
2)				DRAWN	11.04.96SNA		
3)				APPROVED	05.12.96/HWM	PCB CServ4_ANALOG	
4)							
5)				ISSUED	M&E/MIKLOSS		

[1996, 12, 6, 6]
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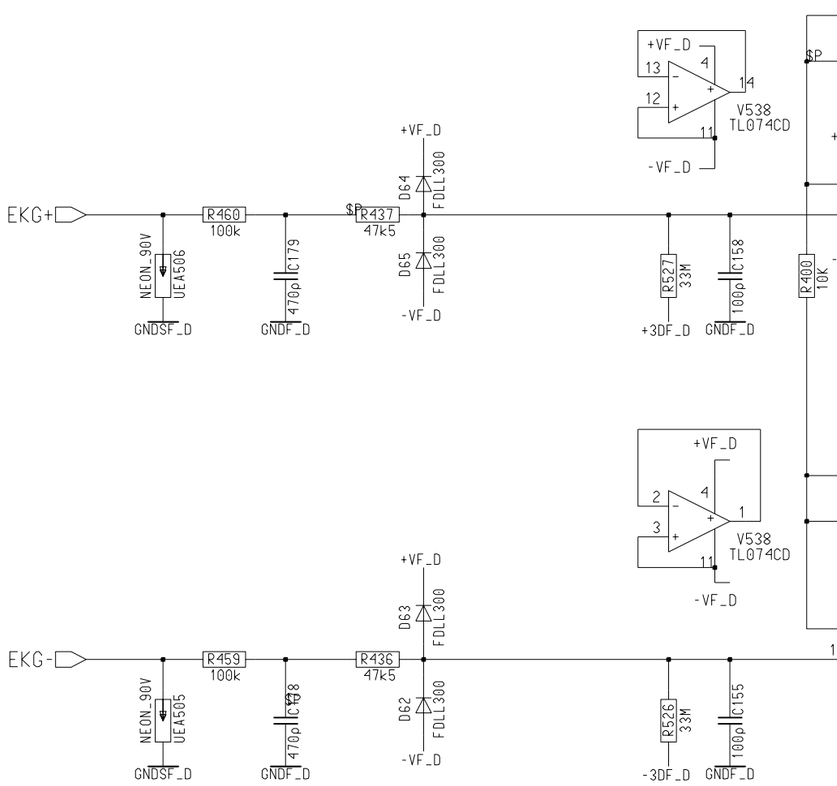
HIGH_VOLTAGE

Schutzvermerk nach DIN 34 beachten

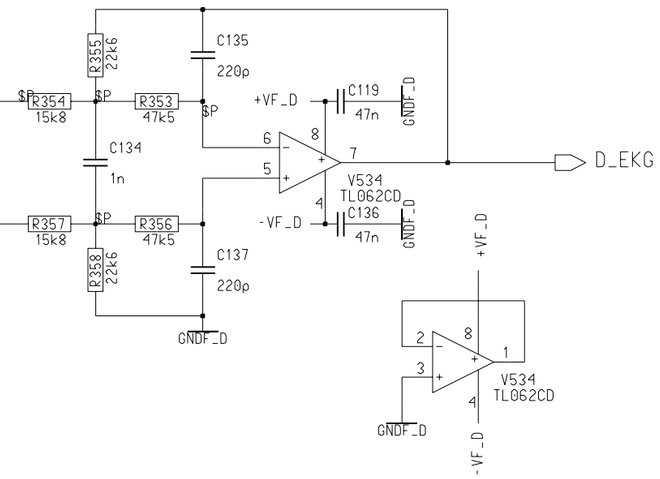
Marquette Hellige GmbH D-79007 Freiburg	388 032 05 P
	Sheet: 5 of 11
Not equipped in Version :	REVISIONS: Revision-No / Index / Date / Name; A03; F67213
1) 388 032 05	Date / Name
2)	DRAWN 11.04.96/SNA
3)	APPROVED 05.12.96/HWM
4)	
5)	ISSUED M&E/MIKLOSS
	LPL CServ4_ANALOG
	PCB CServ4_ANALOG

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/high_voltage

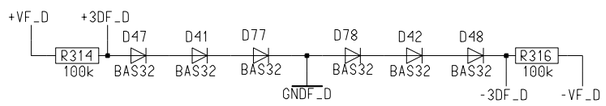
PRE AMPLIFIER



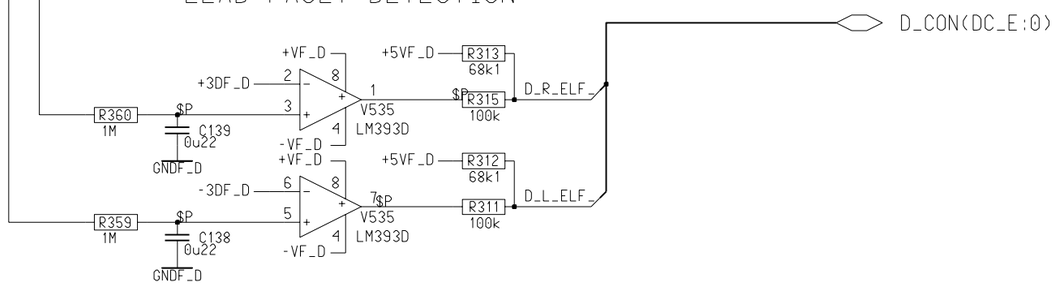
PAD ECG AMPLIFIER



GUARD CIRCUIT



LEAD FAULT DETECTION



D_ECG_INPUT

Marquette Hellige GmbH D-79007 Freiburg					388 032 05 P	Sheet: 6 of 11
Not equipped in Version :	REVISIONS Revision-No	Index	Date / Name	A03	F67213	
1) 388 032 05					Date / Name	
2)				DRAWN	11.04.96/SNA	LPL CServ4_ANALOG
3)				APPROVED	05.12.96/HWM	PCB CServ4_ANALOG
4)						
5)				ISSUED	M&E/MIKLOSS	

Schutzvermerk nach DIN 34 beachten

D_ECG_FILTER

FILTER

C107 33p, R233 200K, C531 0U1, R264 33K2, R265 475K, R234 90k9, R266 33K2, R267 1k62, C99 15n, TL064CD V520, +VF_D, -VF_D, GNDF_D

RECTIFICATION

4016 14, Z518 7, R304 249k, C537 47n, R303 332k, C115 10n, 0U47 C536, R300 100K, R261 100K, R232 100K, R262 200K, BAS32 D46, BAS32 D40, R301 10k, R263 249k, R302 200K, C105 47n, C106 47n, TL064CD V520

TRIGGERING

R259 10k, C103 47n, R260 1M, C535 1U, LM339 V519, R230 1M, R229 182K, R231 10k, R258 2k43, BAS32 D45, TL062CD V523, C113 47n, BAS32 D50, C128 47n, R239 2K43, R297 15k8, R296 33k2, R298 1k, R228 10k, +5VF_D, HF_TRIGGER

PACE SLEWRATE DETECTION

C540 220p, R310 100k, R277 499k, R278 2k43, R275 2k43, R276 499k, C532 1n, R279 1k, TL064CD V522, 499k R308, 0U1 C117, 4011 Z8, 4538 Z520, GNDF_D, +VF_D, -VF_D

PACE DIRECTION

C118 0U1, R309 499K, 4538 Z520, R352 100k, R351 68k1, R227 499k, R226 10k, P_DIRECTION

PACE AMPLITUDE DETECTION

C110 68p, R270 2M32, R273 18K2, R271 18K2, R239 1M, R274 1M, R272 18K2, R238 18K2, R237 2M32, R235 4K99, R236 4K99, TL064CD V521, V522, C109 47n, C108 47n, 4011 Z8, CD4053 Z6, R268 499k, 4016 Z5187, C539 1U, V524, D_EKG

PACE

R256 10K, D44 BAS85, C114 47n, R257 100R, C102 0U1, LM339 V519, PACE

PADDLE AC AMPLIFIER

C129 47p, TL064CD V533, R344 56k2, R522 100k, Gain, R346 499k, R347 332k, C153 0U1, R391 332k, R392 2k43, R390 10k, R345 100k, R524 100k, Offset, R350 332k, R349 1K, R348 3K32, C542 1U, C131 47n, C130 47n, R305 100K, C538 0U1, F_D_EKG, R269 100K, C116 0U1, R306 12k1, R307 12k1, TL064CD V524

PACE-BLOC

ECG, BLOC

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 05 P	Sheet: 7 of 11
Not equipped in Version :	REVISIONS				A03	F67213	
	Revision-No	Index	Date / Name			Date / Name	
1) 388 032 05	202 826	A	14.04.97/JOK				LPL CServ4_ANALOG
2)				DRAWN	11.04.96/SNA		
3)				APPROVED	05.12.96/HWM		PCB CServ4_ANALOG
4)							
5)				ISSUED	M&E/MIKLOSS		

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/d_ekg_filter

D_ECG_CONTROL

STATUS REGISTER

STATE MACHINE

QSPI INTERFACE

ADC

3,6MHZ-OSCILLATOR

5V SUPPLY

FLOATING

NON FLOATING

FROM E_ECG_CONTROL
SWITCHING REGULATOR

D_CON(DC_E:0)
HF_TRIGGER
P_DIRECTION
PACE
F_D_EKG

CONTROL(CO_E:0)
SCKEXT
MOSIEXT
PCS2EXT
MISOEXT

+5VF_D
+5VRF_D
+VF_D
+2.5VF_D
+5V
+7,5V
-VF_D
-7,5V
+12VSR
SR_VSW
GNDFD_D
GNDSF_D
GND

74HCT14
74HCT166
74HCT125
74HCU04
LTC1290
LMC6484
LM393D
TL750L05
ECG_CONTROL
16V8
HCPL2630
IS609
BAS29
TR503
30343948
3.6864MHZ

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH	D-79007 Freiburg
388 032 05 P	Sheet: 8 of 11
LPL CServ4_ANALOG	
PCB CServ4_ANALOG	

Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67213
1)	388 032 05					Date / Name
2)					DRAWN	11.04.96/SNA
3)					APPROVED	05.12.96/HWM
4)						
5)					ISSUED	M&E/MIKLOSS

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/d_ekg_control

CHARGE_CONTROL

EMERGSTOP

PACHARGE_ PAD/1 100R R477 R475 10k 1M R476 BAS32 D76 R451 1k BAS32 D75 C170 47n LM358D V541 R453 47k5 +12V +5V GND

PADISCHARGE_ PAD/2 100R R473 R474 10k 1M R450 BAS32 D74 R449 1k BAS32 D73 C169 47n LM358D V541 +12V +5V GND

RECSTART_ PAD/3 100R R471 R472 10k 1M R468 BAS32 D68 R470 1K BAS32 D69 47n C168 R448 47K5 LM358D V543 +12V +5V GND

PAD/4 PAD/5 PAD/6 PAD/7 PAD/8 R464 10k R469 4K75 R465 4K75 R466 4K75 R446 4K75 1M R467 C180 0U1 LM358D V540 0R R463 0R R445 0R R444 L503 100U L502 100U +5V +12V GND

ELECT3 ELECT2 ELECT1 PAPRINT TACHARGE_ TADISCHARGE_ DISCHARGE_ CHARGE_ ENERGYSELECT RELE SYNC_ RESDEF_ FDIS RESET AIMESS CONTROL(CO_E:0)

0U1 C549 R409 2k43 0U1 C547 R407 2k43 R417 100K BAS32 D58 R412 10k R408 10k R410 10k R411 10k C543 0U1 C145 0U1 R328 100k 15k8 R371 0U1 C144 C167 0U1 C160 0U1 C548 1u BAS32 D57 R447 499K 4001 4002 4023 4013 74HCT14 Z532 Z524 Z523 Z525 Z526 Z521 +5V GND

s2_relais REL502 REL_E BAS32 D59 +12VD R413 15k8 T11 BC847B R414 100k

s2_relais REL500 REL_D BAS32 D39 +12VD R452 47k5 R415 15k8 T12 BC847B R416 100k

BSS295 T503 BAS32 D67 R406 22K6 D66 BAS32 RELAIS_C REL503 REL504 6R81 R529 6R81 R528 R443 10k R401 100K BC327-25 T502 R362 2K43 R438 10k R405 100k BC847B T10 22k R403 475k R440 475k R439 C550 1U R404 10k R441 10k C546 1U R442 10k R402 10k V539 LM393D +12VD +5V GND

TEST/1 TEST/2

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 05 P	Sheet: 9 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67213	
1)	388 032 05					Date / Name	LPL CServ4_ANALOG
2)					DRAWN	11.04.96/SNA	
3)					APPROVED	05.12.96/HWM	PCB CServ4_ANALOG
4)							
5)					ISSUED	M&E/MIKLOSS	

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/charge_control

CHARGE_GENERATOR

Marquette Hellige GmbH D-79007 Freiburg						388 032 05 P
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67213
1)	388 032 05	202 826	A	14.04.09/JOK		Date / Name
2)		202 957	B	15.07.97/JOK	DRAWN	11.04.96/SNA
3)					APPROVED	05.12.96/HWM
4)						
5)					ISSUED	M&E/MIKLOSS

LPL CServ4_ANALOG

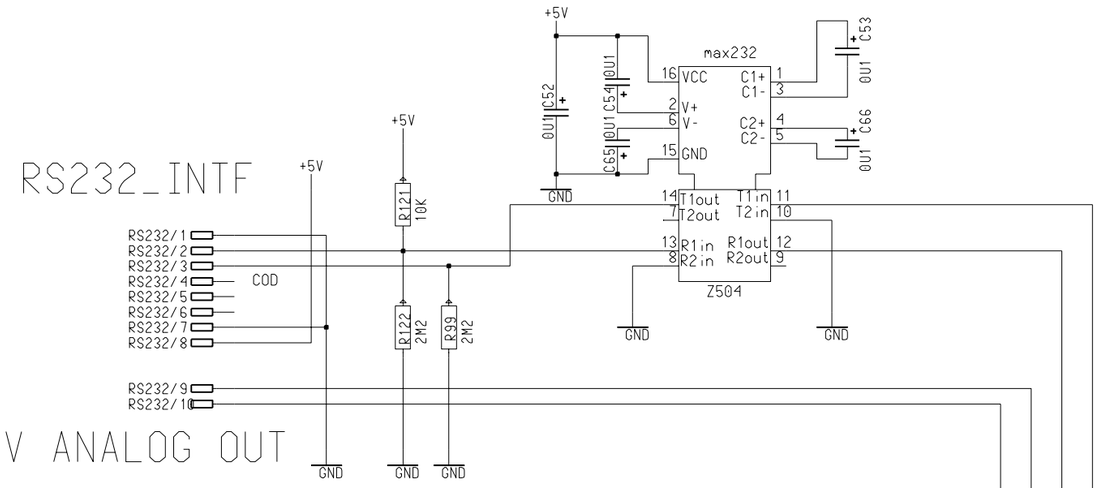
PCB CServ4_ANALOG

Sheet: 10 of 11

Schutzvermerk nach DIN 34 beachten

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/charge_generator

RS232_INTF

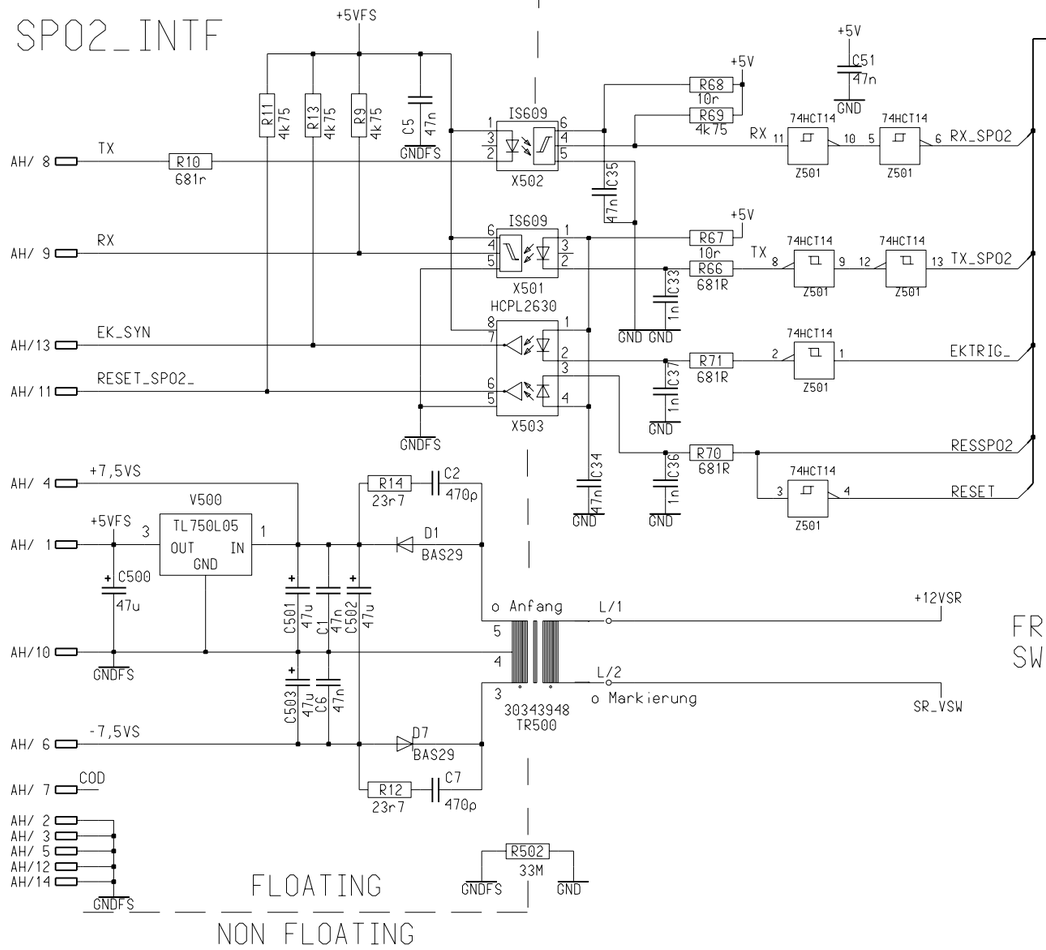


1V ANALOG OUT

GND1V
A1VOUT
RxD
TxD

CONTROL(CO_E:0)

SPO2_INTF



FROM E_ECG_CONTROL
SWITCHING REGULATOR

FLOATING

NON FLOATING

CONN_INTF

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg					388 032 05 P	Sheet: 11 of 11
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67213
1)	388 032 05					Date / Name
2)					DRAWN	11.04.96/SNA
3)					APPROVED	05.12.96/HWM
4)						
5)					ISSUED	M&E/MIKLOSS
					LPL CServ4_ANALOG	
					PCB CServ4_ANALOG	

[1996, 12, 6, 6]
$USER_CAD_A/f67213/design/conn_intf

BT-AS = 768
BT-BS = 257
LOET-AS = 2260
LOET-BS = 981

2/432 523 91

903 449 88

ROT

2/923 096 86

5/829 074 88

2/908 122 01

beidseitig verlacken mit 826 009 23

Draht umgebogen

6/916 189 62

923 081 00 Ferritkern an Bohrung im Spulenkoerper befestigen.

6/915 392 00

2/915 413 26

3/915 413 25

442 010 25

50465926

50465924

6/916 189 03

442 010 07

433 672 13

2/442 010 05

Welle

Reflow

kodiert

Markierung rot

D517 waagerecht und hochkant an L/3 + L/4

2/927 227 44

442 018 02

915 415 24

2/927 229 31

BARCODE

923 081 00

923 096 69

Draht umgebogen

4/929 164 60

4/Bauteilenden auf AS umgebogen

4/Plastite 45 3x10
801 777 09

3/927 227 77

Hierzu Drahtsatz: 383 272 95

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg					388 032 05 R BL1/2
REVISIONS				AGE F87213	
Revision-No	Index	Date/Name		Date/Name	LPL. CServ4_ANALOG
————	A	04.12.96/JÖK			
202826	B	14.04.97/JÖK	Drawn	08.07.96/JÖK	PCB CServ4_ANALOG
202943	C	28.04.97/JÖK	Approved	08.07.96/JÖK	
202967	D	16.07.97/JÖK	Issued	M&E/WIKLOSS	

3x ZINNFREI

2x ZINNFREI

433 672 13

KLEBEN

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg					388 032 05 R BL2/2
REVISIONS				A02 F872213	
Revision-No	Index	Date/Name		Date/Name	LPL. CServ4_ANALOG
———	A	04.12.96/JOK			
202826	B	14.04.97/JOK	Drawn	08.07.96/JOK	PCB CServ4_ANALOG
202864	C	28.04.97/JOK	Approved	08.07.96/JOK	
202867	D	19.07.97/JOK	Issued	M&E/MTKLOSS	

NICHT BESTUECKT:
NOT EQUIPPED:

Sheet 1: C19, C20, C21, R514, R523
Sheet 2: AK, DEBUG, R96, R102, R?, R?, R?, T?, Z504
R135, C34, C32, C518, C26, R54, D17
Sheet 3:
Sheet 4: OPTREX, OBACKL, C52, X501
Sheet 5: D10, R508, R509, R3, T1, R10
Sheet 6:

SIEHE HIERZU :
SEE ALSO :

388 032 06 SHEET 1 BIS 6

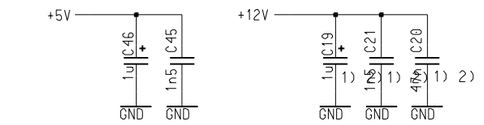
Schutzvermerk nach DIN 34 beachten

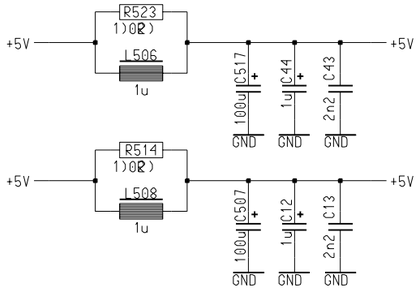
HELLIGE GMBH
Postfach 728
D-79007 Freiburg

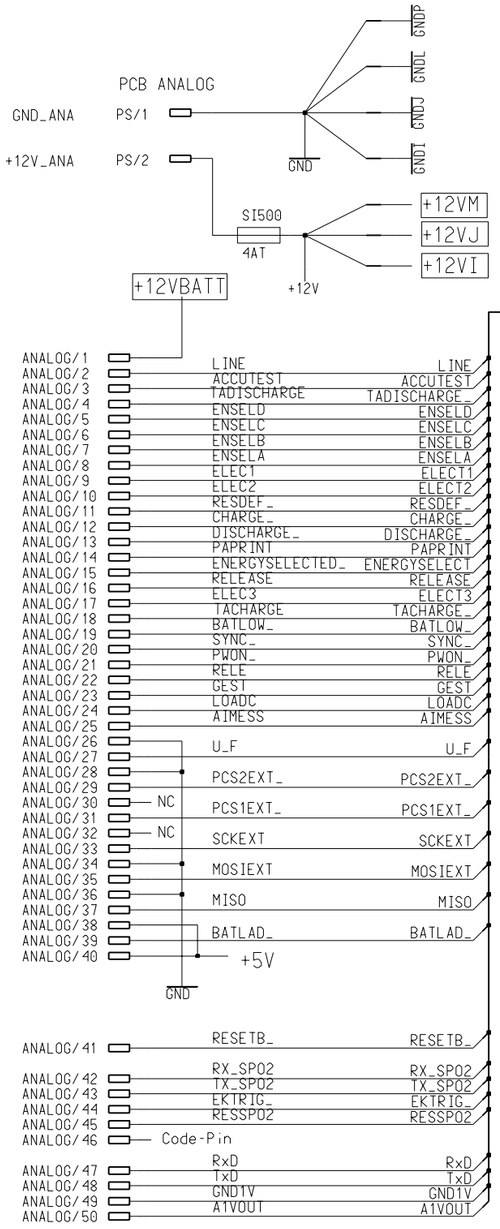
388 032 06 P

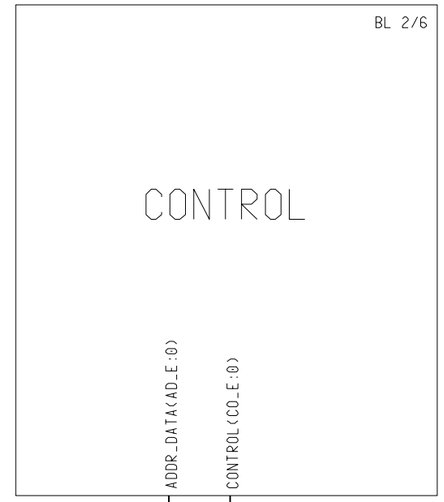
AENDERUNGEN Aend. -Nr.	Index	Datum/Name	A04	F67214
				Datum/Name
			gez.	02.10.96/SNA
			gepr.	
			Entw.	SNA,MLM

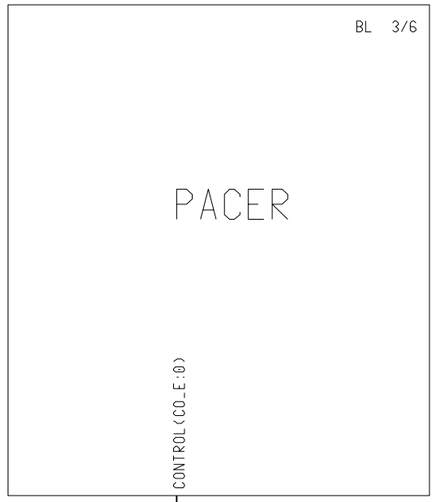
LPL. CServ4_DIGITAL
PCB CServ4_DIGITAL

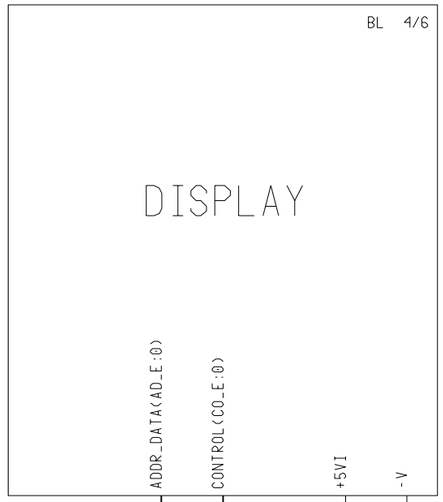


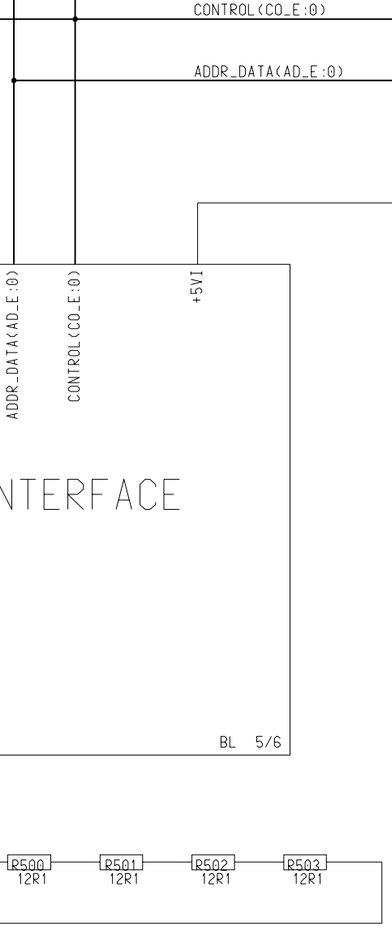


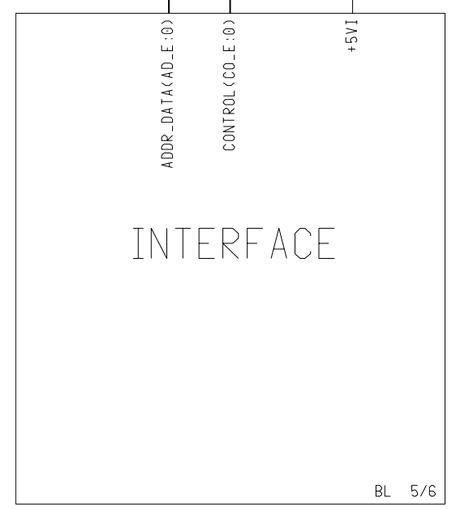


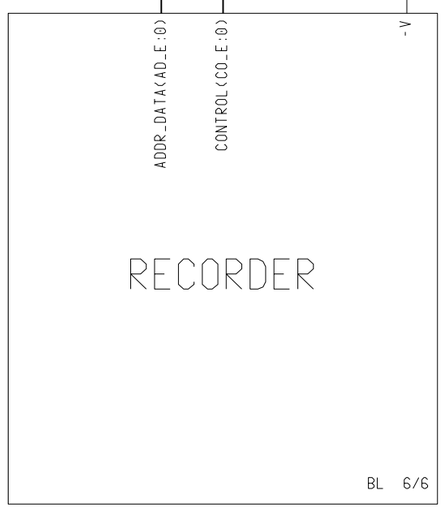


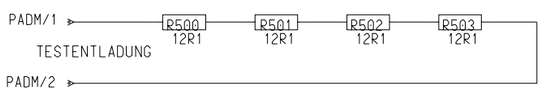












Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 06 P	Sheet: 1 of 6
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67214	
1)	388 032 06					Date / Name	LPL CServ4_DIGITAL
2)	388 032 53				DRAWN	09.12.96/SNA	
3)					APPROVED	09.12.96/SNA	PCB CServ4_DIGITAL
4)							
5)					ISSUED	ALLGEIER M&E	

[1996, 12, 9, 2]
$USER_CAD_A/f67214/design

ADDR_DATA(AD_E:0)
CONTROL(CO_E:0)

EPROM
27C4096
DIP
Z506

FLASH
AM29F400
Z504

RAM
HM628128LFP-7
Z17
Z18
Z19
Z20

CONTROLLER
MC68332
Z505

EEPROM
93C46_56_66
Z9

WATCHDOG
max695
Z8

DEBUG INTERFACE

74HCT00
Z22

+5V
+5VSRAM
GND
RESETB_
RW_
CSBOOT_
FLASH_OE
DEBUG(DE_E:0)
TSTIME_
BKPT_
FREEZE
IFETCH_
IPIPE_

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 06 P	Sheet: 2 of 6
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67214	
1)	388 032 06					Date / Name	
2)	388 032 53				DRAWN	09.12.96/SNA	LPL CServ4_DIGITAL
3)					APPROVED	09.12.96/SNA	PCB CServ4_DIGITAL
4)							
5)					ISSUED	ALLGEIER M&E	

[1996, 12, 9, 2]
$USER_CAD_A/f67214/design/control

NO floating

floating

CONTROL(CO_E:0)

PACE_CONTROL

PIC16 Z510

MAX809 X507

PACE_TX

PACE_RX

PACE_IMP

PACE_EN

PACE_IMPULSE

UART_RX

UART_TX

PHASE_A

PHASE_B

HVF

+5VF

+12V

GNDF

GNDFH

GNDP

PACE/2

PACE/ 1

floating

NO floating

PACER

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 06 P	Sheet: 3 of 6
Not equipped in Version :		REVISIONS			A03	F67214	
		Revision-No	Index	Date / Name			
1)	388 032 06	202823	A	16.04.97/MSG		Date / Name	
2)	388 032 53	203084	B	16.09.97/JOK	DRAWN	09.12.96/SNA	LPL CServ4_DIGITAL
3)					APPROVED	09.12.96/SNA	PCB CServ4_DIGITAL
4)							
5)					ISSUED	ALLGEIER M&E	

[1996, 12, 9, 2]
$USER_CAD_A/f67214/design/pacer

LCD CONTROL

CONTROL(CO_E:0)
ADDR_DATA(AD_E:0)

Z10 74HCT86 =1
DISP_INV
DISP_OFF_

MSM6255GS

UD0 UD1 UD2 UD3
LD0 LD1 LD2 LD3
FRP LIP CE0 CLP FRMB
LCDDISP_OFF_
UDX1 UDX0 UDX3 UDX2
LCDCON(LC_E:0)

+5V
RN507 10k
RN507 10k
R166 10k
RN514 10k

HOSIDEN-LCD
HOSIDEN/ 1 V0
HOSIDEN/ 2 VEE
HOSIDEN/ 3 D3
HOSIDEN/ 4 D2
HOSIDEN/ 5 D1
HOSIDEN/ 6 D0
HOSIDEN/ 7 M
HOSIDEN/ 8 VSS
HOSIDEN/ 9 VDD
HOSIDEN/10 CP2
HOSIDEN/11 CP1
HOSIDEN/12 S
HOSIDEN/13 DISP_OFF_
HOSIDEN/14 FG
Bestueckt bei HOSIDEN-LCD

MA0 MA1 MA2 MA3 MA4 MA5 MA6 MA7 MA8 MA9 MA10 MA11 MA12 MA13 MA14
MA15
XT XT_ TEST1 TEST2 CH0 RA0 RA1 RA2 RA3
C38 22p
QU502 3.6864MHZ
C31 22p
VDD +5V
VSS

OPTREX-LCD
OPTREX/ 1 FLM
OPTREX/ 2 LP
OPTREX/ 3 CP
OPTREX/ 4 M
OPTREX/ 5 VADJ
OPTREX/ 6 VCC
OPTREX/ 7 VSS
OPTREX/ 8 VEE
OPTREX/ 9 D0
OPTREX/10 D1
OPTREX/11 D2
OPTREX/12 D3
OPTREX/13 DISP_OFF_
OPTREX/14 NC
1) 2)
Bestueckt bei OPTREX-LCD

TIME-OF-DAY CLOCK

RTCCE
RTCCLK
RTCDATA
IRQ2_
RTC4513
NC1 NC2 NC3 VDD NC4 NC8 CLK STD.P CE NC7 NC6 GND NC5
X506
GND

D508 BAT83 +5V
R118 10k
D19 BAS85
C39 0u1
C40 47u
BA500
BAT_3V
GND GND GND

AD_4
AD_1

CPU_INTERFACE

+5V
RN509 10K
RN509 10K
RN509 10K
RN513 10K

KB_ROW2_ KB_ROW1_ KB_ROW0_ LCDWR_ KBSEL2 RTCRD_ RTCCS_ KBSEL1 PWM_SLAVE PWM_MASTER LCDCONTCS_ PACE_EN LCDRD_ RTCWR_
OEN_
RESETB_ AS_ CS8_
RW_ DCLKOUT

I00 I01 I02 I03 I04 I05 I06 I07 I08 I09 I010 I011 I012 I013 I014 I015
I0 I1 I3 I4
CLK0_I2 CLK1_I5
MACH210
Z502

I016 I017 I018 I019 I020 I021 I022 I023 I024 I025 I026 I027 I028 I029 I030 I031
KBRD_ RECWR_ LCDRAMWR_ LCDRAMCS_ PWM_CONTRAST KB_ROW3_ CS10_ CS9_ RECRD_ DCLKOUT CLKOUT
PHASE_A PHASE_B

RN510 10K +5V

R53 470R
GND

CONTRAST

+5V
R97 3k16
R515 KTY10
R76 7k15
-VREF
PWM_CONTRAST
LM358D V5a
R77 90k9
C30 0u1
R90 1M
LM358D V5b
74HCT00 Z5
R91 182k
GND +5V

-23V VOLTAGE SUPPLY

+12VI
+5V
max637acsa X1
-VOUT VREF LBO GND +VS LX LBI VFB
C10 0u1
C505 22u
GND GND
R19 2k2
BC847B T6
R17 200R
D501 ZPD15
R9 1k
T5 IRFR9024
C500 220u
C7 0u1
GND GND
R18 2k2
R30 28k7
C9 0u1
R31 499k
GND GND GND GND GND
D2 BYM12-150
C501 220u
C8 0u1
L500 330u
GND GND
-V

LCD BLOCK

+5V
R43 22k
BSS84 T11
C29 0u1
GND
D5 BAS32
BSS138 T9
R20 22k
R32 162k
BSS138 T10
R21 22k
GND GND

* SIEHE BLATT 0

LCD RAM

AD_0 AD_1 AD_2 AD_3 AD_4 AD_5 AD_6 AD_7 AD_8 AD_9 AD_10 AD_11 AD_12 AD_13 AD_14 AD_15
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15

74HCT245
LCDRAMCS_
LCDRAMWR_
G3 3 EN1[BA] 3 EN2[AB]
RD_0 RD_1 RD_2 RD_3 RD_4 RD_5 RD_6 RD_7
D_8 D_9 D_10 D_11 D_12 D_13 D_14 D_15
Z13

D_8 D_9 D_10 D_11 D_12 D_13 D_14 D_15
DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7

LCDRD(LR_E:0)
RN507 10k
RN506 10k
RN504 10k
RN506 10k
R173 10k
RN521 10k
RN521 10k
RN522 10k
+5V

RD_0 RD_1 RD_2 RD_3 RD_4 RD_5 RD_6 RD_7
RD0 RD1 RD2 RD3 RD4 RD5 RD6 RD7

CS9_ LCDCONTCS_ LCDRD_ LCDWR_ RESETB_
DIEN BUSY CS_ RD_ WR_ RES_ DIV_ ADF_

R98 470R
RN515 10k
GND +5V
Z503

LCDRAMWR_
GND GND
R52 470R
R51 470R
+5V
HM62256LFP-7
VCC GND _CE R_W _OE A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14
GND

LCDMA(LA_E:0) +5V
MA_0 MA_1 MA_2 MA_3 MA_4 MA_5 MA_6 MA_7 MA_8 MA_9 MA_10 MA_11 MA_12 MA_13 MA_14
RN506 RN505 RN505 RN504 RN505 RN506 RN504 RN504 R165 RN514 RN502 RN502 RN505 RN514 RN514
10k

RD_0 RD_1 RD_2 RD_3 RD_4 RD_5 RD_6 RD_7
IO1 IO2 IO3 IO4 IO5 IO6 IO7 IO8
Z501

CCFT SUPPLY

+5VI
VIN VOUT1 VOUT2 GND COMMON CXA_K10A
X500
C1 0u1
GNDL
HOSIDEN-LCD
HBACKL/1 FL HOT
HBACKL/2 NC
HBACKL/3 NC
HBACKL/4 FL GND
Bestueckt bei HOSIDEN-LCD

Bestueckt bei OPTREX-LCD
C52 0u1
1) 2)
1) 2X501
OPTREX-LCD
OBACKL/1 FL HOT
OBACKL/2 NC
OBACKL/3 NC
OBACKL/4 FL GND
1) 2)

DISPLAY

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg					388 032 06 P	Sheet: 4 of 6
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67214
1)	388 032 06	202 768	A	05.03.97/JOK		Date / Name
2)	388 032 53				DRAWN	09.12.96/SNA
3)					APPROVED	09.12.96/SNA
4)						
5)					ISSUED	ALLGEIER M&E

LPL CServ4_DIGITAL
PCB CServ4_DIGITAL

[1996, 12, 9, 2]
$USER_CAD_A/f67214/design/display

ADDR_DATA(AD_E:0)
CONTROL(CO_E:0)

KEYBOARD INTERFACE

KEYBOARD

KB_ROW0_ KB_ROW1_ KB_ROW2_ KB_ROW3_ — BAS85 D23 D24 D25 D26 — KEYB/ 1 KBROW0_ KEYB/ 3 KBROW1_ KEYB/ 8 KBROW2_ KEYB/10 KBROW3_

LINE TAENABLE TADISCHARGE_ TACHARGE_ — KEYB/14 LINE KEYB/13 TAENABLE KEYB/12 TADISCHARGE_ KEYB/11 TACHARGE_

KEYB/ 7 NC
KEYB/16 BATLAD
KEYB/15 GND
KEYB/ 6 GND

KBRD_ AS_

74HCT574 Z16 — D_0 D_1 D_2 D_3 D_4 D_5 D_6 D_7 — KEYB/ 2 KBCOL0_ KEYB/ 4 KBCOL1_ KEYB/ 5 KBCOL2_ KEYB/ 9 KBCOL3_

74HCT574 Z12 — D_8 D_9 D_10 D_11 D_12 D_13 D_14 D_15

BATLAD_

BATLOW_
ELECT3
RELEASE
CHARGE_
DISCHARGE_
PAPRINT
ELECT1
ELECT2

Z509 74HCT244 — TX_SPO2U RX_SPO2 EKTRIGU_ RESETB_ — TX_SPO2 RX_SPO2B EKTRIG_ RESSPO2

CS_CON_

Z509 74HCT244 — MOSI SCK ACCUTSTU — MOSIEXT SCKEXT ACCUTEST

Z11 74HCT574 — DISP_OFF_ DISP_INV BEEPCTL BEEPON LOADC RELE TAENABLEU ENERGYSELECTU_ — D_0 D_1 D_2 D_3 D_4 D_5 D_6 D_7

ICL7660 Z507 — C41 10U — C42 10U — -5V

MAX504 Z508 — RFB VDD VOUT VSS REFOUT REFIN AGND — BIPOFF DIN CLR_ SCLK CS_ DOUT DGND — MOSI RESETB_ SCK PCS3 — C47 33U

74HCT00 Z22

ENERGY SELECT

SWITCH_1X16BIN — BINARY — S1 S2 S4 S8 — SWITCH — BAS85 D9 D8 D15 D16 — 2k2 R74 R75 R88 R89 — ENSELAU ENSELBU ENSELCU ENSELDU

BAS85 D10 D11 D13 D14 — PWON_

R121 20k — R127 20K — (-2.048V...+2.048V) — V503 LMC6482

74HCT00 Z22 — BEEPON

S500

+12V — R3 1k

R524 68k1 — C520 10n — R128 68k1 — R126 47k5 — C519 22n — V503 LMC6482 — BAS32 D20 D509 — R120 100R — A1VOUT

GND1V — BEEP — R508 6k81 — T1 BC847B — R509 0k — R119 10k

R12 243k — C502 100u — R513 61k9 — C506 0u47 — TDA7052 V500 — R176 24k3 — R511 10k — R512 0R — T8 BSS138 — T27 BSS138 — C11 1n — R11 499k — BEEPCTL RESET_

BEEPER

L501 0u1 — L504 0u1 — BEEP/1 BEEP/2 BEEP/3

R63 10k — T13 BC847B — R64 4k75 — POWERON

DEFI INTERFACE

Z14 74HCT244 — GEST TXDU AIMESSU RxD — GESTB TxD AIMESS RXDB

10K RN531

Z14 74HCT244 — SYNCU_ TAENABLEU ENERGYSELECTU_ RESDEFU_ — SYNC_ TAENABLE ENERGYSELECT RESDEF_

Z15 74HCT244 — PCS1_ PCS2_ — PCS1EXT_ PCS2EXT_ — U_F — R131 4k75

R125 470R

Z15 74HCT244 — RESET_ U_F — RESETB_ U_FB

ENSEL_LE

Z21 74HCT373 — ENSELAU ENSELBU ENSELCU ENSELDU — ENSELA ENSELB ENSELC ENSELD — R162 4k75

nach Test verloeten

IRFR9024 T7 — SI502 500mAT — +5VI

5 VOLT GENERATOR

78SR105HC V502 — +12VM — 2AF SI501 — L505 10u — L507 10u — C515 47u — C516 100u — 1N5340B D507 — 1N5908 D506

OVERVOLTAGE MONITORING

R133 4k75 — T14 BC847B — R132 22k6 — R134 10k — R73 49k9 — R62 49k9 — +VREF — C23 33u — C25 0u1 — LM393D V2

INTERFACE

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 06 P	Sheet: 5 of 6
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67214	
1)	388 032 06	202 727	A	04.02.97/JOK		Date / Name	
2)	388 032 53	202 875	B	06.06.97/MSG	DRAWN	09.12.96/SNA	LPL CServ4_DIGITAL
3)					APPROVED	09.12.96/SNA	PCB CServ4_DIGITAL
4)							
5)					ISSUED	ALLGEIER M&E	

[1996, 12, 9, 2]
$USER_CAD_A/f67214/design/interface

RECORDER

CONTROLLER

ADDR_DATA(AD_E:0)
CONTROL(CO_E:0)
DATA_REC(DR_E:0)
CONTROL_REC(CR_E:0)
80C51
Z500
12MHZ
74HCT574
Z1
Z6
74HCT574
74HCT574
Z7
74HCT00
Z5
74HCT164
SRG8
CD4051B
Z4
Z2
74HCT244
Z3

HEATING PERIOD

ICM7556
X2a
X2b
HEAT_PULSE
PVIN_
OVLOAD
MISEN_

HEATING PERIOD CUTOFF

LM339
V3c
LM358D
V1b

HEATING TIME

PVCLK
REC_RES
PVDATA
RESETB_

SPEED SELECTION

LM358D
V1a
SPEED

THERMAL PRINTHEAD

KLATCH
KCLOCK
KDATA
300us-900us
MP1/1
MP2/1
PRINT/9 KLA
PRINT/11 KCLK
PRINT/13 KDAT
PRINT/18 KSTRB
PRINT/19 KSTRB
PRINT/20 KSTRB
PRINT/21 KSTRB
PRINT/22 KSTRB
PRINT/23 KSTRB
PRINT/24 KSTRB
PRINT/25 TERM1
PRINT/ 7 +5V
PRINT/26 TERM2
PRINT/ 2 GNDJ
PRINT/ 4 GNDJ
PRINT/ 6 GNDJ
PRINT/ 8 GNDJ
PRINT/10 GNDJ
PRINT/12 GNDJ
PRINT/14 GNDJ
PRINT/ 1 +22V
PRINT/ 3 +22V
PRINT/27 +22V
PRINT/28 +22V
PRINT/29 +22V
PRINT/30 +22V
PRINT/ 5 +VDD1
PRINT/15 NC
PRINT/16 NC
PRINT/17 NC

+22V VOLTAGE SUPPLY

MC33063
V501
IRFR024
T4
BYW29/100
D500
L503
L502
BC807-25
T2
BSS138
T3
BAS85
D1
D4
D3

PRINTHEAD BLOCK

MOTOR REGULATION

LT1013DS8
V4b
BD809
T500
LT1013DS8
V4a
BAS32
D7

MOTOR CURRENT CONTROL

LM339
V3a
LM339
V3b
LED_RT
LED1
TL431CLP
D505
D503

REFERENZ

+VREF
-VREF
MP3/1

SPEED

COMPENSATION

MOTOR

PRINT/31 MOTOR+
PRINT/32 MOTOR-
PRINT/33 SENSE
PRINT/34 GND

Schutzvermerk nach DIN 34 beachten

Marquette Hellige GmbH D-79007 Freiburg						388 032 06 P	Sheet: 6 of 6
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A03	F67214	
1)	388 032 06					Date / Name	
2)	388 032 53				DRAWN	09.12.96/SNA	LPL CServ4_DIGITAL
3)					APPROVED	09.12.96/SNA	PCB CServ4_DIGITAL
4)							
5)					ISSUED	ALLGEIER M&E	

[1996, 12, 9, 2]
$USER_CAD_A/f67214/design/recorder

BT-AS = 301
BT-BS = 211
LOET-AS =1603
LOET-BS = 660

4/405 174 00
AUF B-SEITE
4/M3x6 DIN 7985

915 417 72

442 002 14

2/927 227 44

915 416 90

915 415 33

383 273 55

3/829 074 88
SCOTCH-BAND

8/917 013 00
8 ANSCHLUESSE AUF AS UMGEBOGEN

915 417 73

908 122 22

SCOTCH-BAND
829 074 88

5/916 189 03

915 414 70

NACH PRUEFUNG
VERLOETEN

915 416 90

433 672 14

2/806 130 68 RIVSCREW
NIETKOPF AUF AS

383 273 55

504 657 17

REFLOW

WELLE

NICHT INS ENGLISCHE UEBERSETZTE HIN-
WEISE NUR FUER FERTIGUNG WICHTIG!
TERMS NOT TRANSLATED INTO ENGLISH
ONLY RELEVANT FOR PRODUCTION!

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg

388 032 06 R BL 1/2

LPL. CSERV4_DIGITAL

PCB CSERV4_DIGITAL

REVISIONS				A03
Revision-No	Index	Date/Name		F67214
-------	B	10.12.96/MSC		Date/Name
202662/727	C	04.02.97/JOK	Drawn	18.07.96/MNS
202768	C1	05.03.97/JOK	Approved	18.07.96/JOK
202823	D	17.04.97/MSC		
203084	E	16.09.97/JOK	Issued	M&E/ALLGEIER

BARCODE

403 114 82 AUF AS

ZINNFREI

xxxxxxxxxx
xxx xxx xx xxxx x

927 227 77

403 114 82 AUF AS

433 672 14

KLEBEN

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg				388 032 06 R BL 2/2
REVISIONS				A03
Revision-No	Index	Date/Name		F67214
-------	A	24.10.96/JOK		Date/Name
-------	B	10.12.96/MSC	Drawn	18.07.96/MNS
202662/727	C	04.02.97/JOK	Approved	18.07.96/JOK
203084	D	16.09.97/JOK		
			Issued	M&E/ALLGEIER

LPL. CSERV4_DIGITAL

PCB CSERC4_DIGITAL

BT-AS = 301
BT-BS = 211
LOET-AS =1603
LOET-BS = 660

4/405 174 00
AUF B-SEITE
4/M3x6 DIN 7985

915 417 72

442 002 14

2/927 227 44

915 415 33

383 273 55

3/829 074 88
SCOTCH-BAND

8/917 013 00
8 ANSCHLUESSE AUF AS UMGEBOGEN

915 417 73

908 122 22

SCOTCH-BAND
829 074 88

915 414 70

NACH PRUEFUNG
VERLOETEN

915 416 90

433 672 14

2/806 130 68 RIVSCREW
NIETKOPF AUF AS

383 273 55

504 657 17

REFLOW

WELLE

NICHT INS ENGLISCHE UEBERSETZTE HINWEISE NUR FUER FERTIGUNG WICHTIG!
TERMS NOT TRANSLATED INTO ENGLISH ONLY RELEVANT FOR PRODUCTION!

Schutzvermerk nach DIN 34 beachten.

Marquette Hellige GmbH D-79007 Freiburg					388 032 53 R BL 1/2
REVISIONS				A03 F67214	LPL. CSERV4_DIGITAL
Revision-No	Index	Date/Name		Date/Name	PCB CSERV4_DIGITAL
202662/727	A	04.02.97/JOK	Drawn	03.02.97/JOK	
			Approved	03.02.97/MSG	
			Issued	M&E/ALLGEIER	

BARCODE

403 114 82 AUF AS

ZINNFREI

xxxxxxxxxx
xxx xxx xx xxxx x

927 227 77

403 114 82 AUF AS

433 672 14

KLEBEN

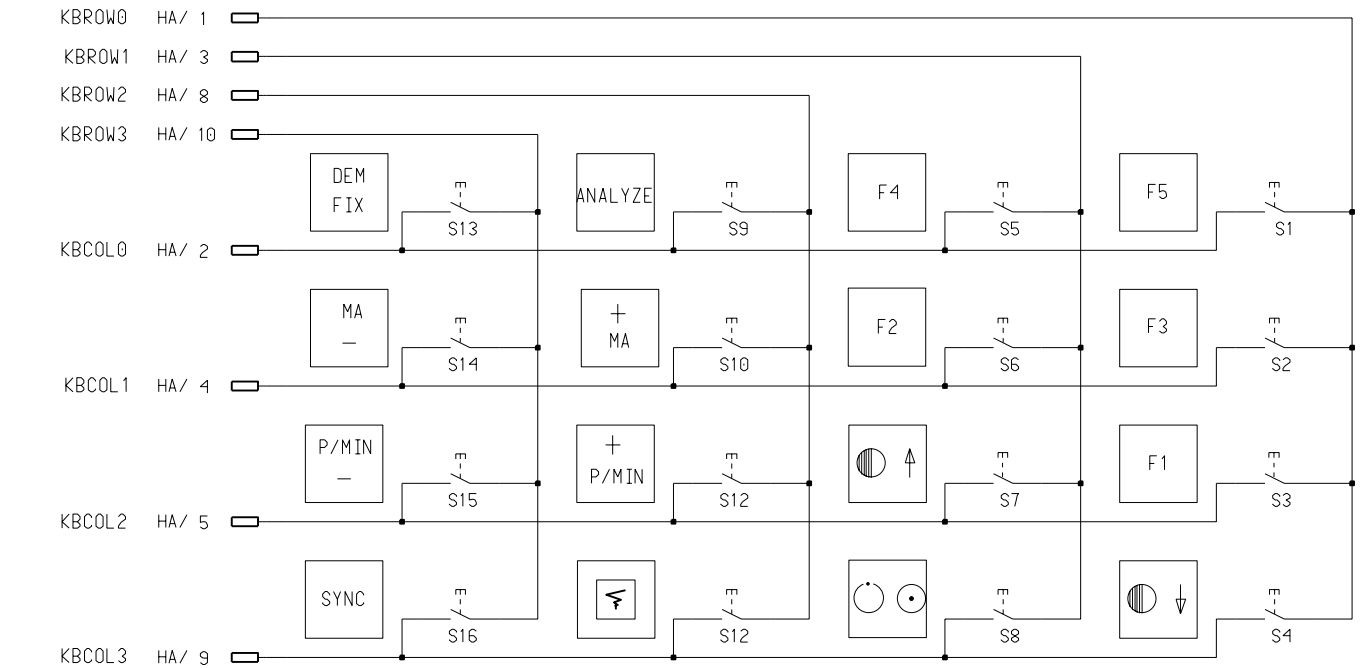
Schutzvermerk nach DIN 34 beachten.

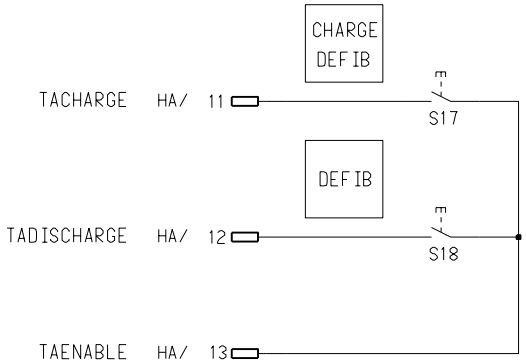
Marquette Hellige GmbH D-79007 Freiburg				388 032 53 R BL 2/2
REVISIONS				A03
Revision-No	Index	Date/Name		F67214
202662/727	A	04.02.97/JOK		Date/Name
			Drawn	03.02.97/JOK
			Approved	03.02.97/MSG
			Issued	M&E/ALLGEIER

LPL. CSERV4_DIGITAL

PCB CSERC4_DIGITAL

Schutzvermerk nach DIN 34 beachten





Marquette Hellige GmbH D-79007 Freiburg						390 001 52 P	Sheet: 1 of 1
Not equipped in Version :		REVISIONS Revision-No	Index	Date / Name	A04	F 67214	
1)						Date / Name	LPL FOLIENTASTATUR
2)					DRAWN	29.07.96/SNA	
3)					APPROVED	29.07.96/SNA	PCB KEYPAD
4)							
5)					ISSUED	ALLGEIER	

[1997, 5, 14, 4]
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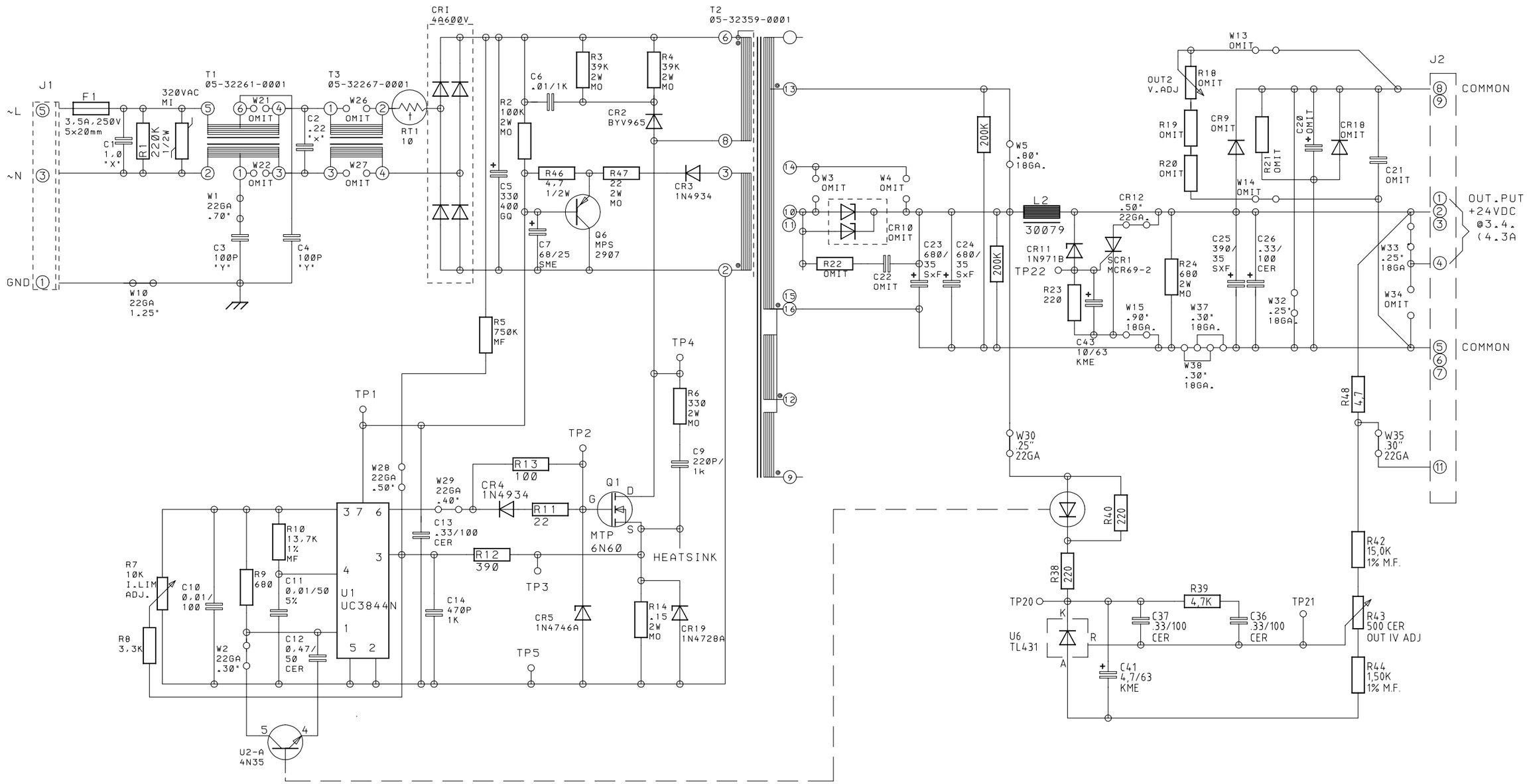

NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%, CF.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS/VOLTS.

Schutzvermerk nach DIN 34 beachten

Änd.-Index	kommt vor	Änd.Nr.	Änderungstext	Datum	Name

Werkstoff

Rohteil

Paßmaß | Abmaße

Oberfläche

Freimaßtoleranz

ACAD-Nr. 03363P1__

Marquette Hellige GmbH
Munzinger Str. 3
D-79111 Freiburg

Maßstab: –

Format: A3

	Datum	Name
Entworfen	22.09.97	G.Kaltenbach
Geprüft	22.09.97	W.Mikloss
Normgepr.		

Sach-Nr. 930 117 97 P

Benennung: Netzteil
16,5 VDC GPM80-15

A PART OF THE
MARQUETTE
HELLIGE
UNITY
NETWORK®

The Marquette Hellige Unity Network® is our response to the critical challenge of managing patient information.
The Unity icon represents more than a network.
It symbolizes our commitment to integrating information and devices throughout a healthcare system.

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MEDICAL SYSTEMS